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THE AMERICAN
JOURNAL OF PHARMACY

VOL. 97. APRIL, 1925 No. 4

EDITORIAL

WHAT IS A MEDICINE? A FRENCH VIEW.

The practice of pharmacy is more closely supervised in Continental Europe than in America. Notwithstanding this supervision, perusal of the pharmaceutical journals of those countries shows that pharmacists have trials and tribulations. They are subject to unfair competition and unjust construction of laws. In France, no one but a qualified pharmacist may sell a medicine, and the question at once arises as to the definition of the term. Anent a certain case, Paul Bogelot, a Paris lawyer, discusses this problem at some length in *Bull. Scien. Pharmacolog.* (1925, *32*, 8). The case arose from the sale of a dentrifice containing a phenolic antiseptic by a retail dealer. Bogelot quotes definitions of the term "medicine" given by Rabuteau and Vulpian but regards them both as indecisive. The question was referred by the Court (as usual in Continental countries) to two experts, who reported that the preparation contained salol and was, therefore, salable only by pharmacists. Objection was made to this report, it being alleged, among other things, that cresolol, not salol, was present. Three other experts were designated. They reported cresolol instead of salol, but agreed with the former experts as to the limitation of sale.

The report not appearing entirely satisfactory to the Judge, he designated three more experts, whose report was, in substance, that the preparation contained essences of anise, mint and fennel with saccharin and an oily compound related to cresolol. They found that the mixture was without toxicity, was harmless and should be admitted to free sale. Naturally, the French lawyer finds these conflicts somewhat amusing, but he points out one agreement. All the experts were of the opinion that the article could be sold without prescription.

Under this disputed condition the case was carried to a higher court, which rendered a decision that it is not possible to hold that the presence of a medicament in any quantity will constitute such a preparation as must be sold only by qualified pharmacists. Such a strict construction would debar the general sale of many hygienic preparations. The twenty-fifth section of the law of 21st Germinal, year 11, (April, 1803) under which the charge was brought, does not bear such drastic interpretation. A Paris Court decided in a case heard in 1914 that the fact that an article contains a substance mentioned in the Codex, does not in itself constitute it a medicament. Menthol lozenges were specifically noted as an example, it being held that the amount of menthol present was so small that a hundred would be needed to produce any positive physiologic effect. Obviously, however, such a view may go too far. Bogelot points out that apart from the composition of the article, one must consider the claims made in the advertisement or on the label. Other judicial decisions are quoted in the essay, but it is not necessary to detail these. Bogelot's opinion is summarized as follows: (1) The presence of a substance having curative properties does not make the mixture a medicament if the proportion is so small as to deprive it of curative action, even though it may exercise some physiologic effect. (2) No matter how slight the action, the preparation becomes the exclusive property of the pharmacist if sold with a view to a curative intention. Obviously, adds our author, there is here much field for debate as to the text of labels and advertisements.

It will be seen from the above that while Laurence Sterne may have been right when he said that they order some things better in France, the difficult questions of definitions as to what constitutes a poison or a medicine is not solved there any more decisively than here. Decisions of courts and opinions of experts tend largely to mere hair-splitting. One important inference that may be drawn from the incidents above detailed is the defect of the European system of state experts. Not infrequently, especially when some trial of great public interest occurs, the "war of the experts" leads many persons to urge the limitation of the expert testimony to those chosen by the authorities, but it is seen that lack of agreement may arise even in that system. There have not been wanting eminent European experts who have advocated the system which has become established in American law, derived from British methods.

HENRY LEFFMANN.

PHARMACY HEADQUARTERS BUILDING WILL BENEFIT EVERYONE.

During the last year practically all pharmacists, whether they be retailers, wholesalers, or manufacturers, have rapidly come to realize that they are a part of the American Pharmaceutical Association. Yes, each and every one who practices pharmacy in any way today is a part of the A. Ph. A.

The seventy-two years of work by the American Pharmaceutical Association has developed and saved to pharmacists all that distinguishes the retail druggist from the hardware man or the hand-me-out-eat-shop proprietor. It is the A. Ph. A. part of the pharmacists which justifies the expressive slogan, "Your druggist is more than a merchant." It is the A. Ph. A. blood in our commercial veins which makes it safe for the general public to "Try the drug store first."

The A. Ph. A. work began in 1852 and continues uninterrupted today. This Association operates on an altruistic basis free from politics.

The present-day concern of the organization outside of the routine work is to render the benefits of the A. Ph. A. accomplishments more available to the general masses of retail druggists. The A. Ph. A. should appeal to druggists of every capacity and occupation. Even as it is now, each and every one breathes the atmosphere of the A. Ph. A. and daily realizes in a financial, if not a mental way, on what has been done for pharmacy by the Association in nearly three-quarters of a century.

Many say that they do not belong to the A. Ph. A. Perhaps not, but that is an anomaly for all are a part of it and it is a part of all in spite of all protests.

Some may be like a bank with only a receiving teller, but the A. Ph. A. accomplishments, like money, is the all-essential to our every existence.

We may resist joining as a child may run away from home, but we cannot avoid being a part of the A. Ph. A. as long as we are pharmacists, any more than a runaway child can cease to be a member of the family unless death severs the physical relation.

Having attended forty consecutive meetings of the A. Ph. A. and taken part in the various activities, I can write knowingly as well as feelingly.

The A. Ph. A. is the only national organization in which all drug interests have an equal right and a mutual interest,—the only one out of ten national drug organizations in operation today.

Napoleon was one of the first great leaders to recognize the practical value of the science of chemistry. Now, chemistry holds a commanding position in the thoughts and lives of men and nations.

The drug journals have been filled with statements of what the A. Ph. A. has accomplished. Who will be the Napoleon of the retail drug trade to recognize the practical everyday value of having a Pharmacopœia, a National Formulary, Drug Laws, Colleges, Boards, the N. A. R. D., the A. C. P. F., the N. A. B. P., A. D. M. A., N. W. D. A., the Drug Trade Conference, Pharmaceutical Research and multifarious other things that go to make up the conditions in drugdom?

Someone is needed who can humanize the past of the A. Ph. A. as Wells has humanized the history of man from his very beginning. Someone should make us thirst for a more intimate knowledge of the A. Ph. A. and realize the full bearing it has on our present and our future.

The A. Ph. A. has always been actively at work doing many things for the benefit of Pharmacy as a whole. At the present time its greatest effort is toward the establishment of a great central Headquarters Building which may serve all of pharmacy. The success thus far attained on this project will stand for all time as one of the remarkable achievements of pharmacy.

The successful completion and operation of the Headquarters Building will be of great benefit to everyone connected with pharmacy in any way. All who have not already done so should therefore subscribe now.

HENRY M. WHELPLEY.

ORIGINAL ARTICLES

CHEMISTRY IN AND ABOUT THE HOME.*

Freeman P. Stroup, Ph. M.,

Professor of Chemistry, Philadelphia College of Pharmacy and Science.

The average individual does not realize how very intimately our everyday activities are tied up with chemical phenomena, that probably the action of every organ of our bodies is accompanied by some one or more chemical changes, that, whether in motion or at rest, asleep or awake, every one of us is in a very true sense a chemical laboratory or factory. The detailing of the processes carried out constantly, or occasionally, as the case may be, would be a long story, though an exceedingly interesting one. Perhaps we shall try some day to tell it, but we have another story to tell tonight which comes very close to most of us, a story which shows us that the home, too, is in a very real sense a chemical laboratory.

While it is true that the study of some phases of chemical science offers difficulties that the keenest of minds have not yet been able to surmount, there are many others of so simple a character that the layman of average intelligence and no special training can easily understand them, yet which often exercise a profound influence in determining our happiness or unhappiness, according as we do or do not take cognizance of them.

It is almost, if not quite, impossible to consider chemical phenomena without noting those of a physical character. There does not seem to be the sharp dividing line between chemistry and physics as many of us may once have imagined as existing. Chemical changes are perhaps always accompanied by physical changes (not always easily noticeable, however), though the reverse is not always, or even generally true.

About a year ago the speaker started out, in a lecture given in this room, to demonstrate chemistry in the home, but, though he talked rather rapidly for considerably more than an hour, he got no farther into the subject than, figuratively, to get the fires in the

*One of a series of Popular Lectures given at the Philadelphia College of Pharmacy and Science, 1924-1925 season.

heater and kitchen stove going in good shape, and the house comfortably heated, without waste of fuel and without danger to the household. When he began this year to get together data for another lecture on the subject he soon realized that there is still more to be said than can be covered properly in an hour or so, and the question that first demanded an answer was: How can this subject be presented in order to bring out a lot of valuable information for his hearers in a rather limited amount of time, and yet in an interesting manner? What follows is his solution of the problem.

The speaker asks you to accompany him as he follows the footsteps of Mrs. Average Housekeeper as she goes about the performance of her duties in her home on a Monday morning of any week in winter. It is to be hoped that you got well rested over Sunday, for we are destined to do "some walking" if we take a step for every step she takes this day. It is too bad that someone has not a pedometer on his foot to record the distance we shall travel.

In the language of Scripture, "She riseth while it is yet night and giveth meat to her household," but before she can serve that meat she has to initiate and carry out a number of chemical reactions. Her house not being an "electric home," she first strikes a match and at once initiates a group of reactions. Let us see what some of them are.

If the match she uses is a so-called "strike anywhere" match, its head is composed of an intimate mixture of (a) a cementing material (probably glue), (b) an oxidizing agent (potassium nitrate, potassium chlorate, brown oxide of lead, or some other chemical which easily parts with part or all of its combined oxygen), (c) a combustible material (phosphorus sulphide, sulphur, antimony sulphide, or some other chemical which easily takes up oxygen), (d) a gritty material (fine emery, pumice, powdered glass, or some other substance which helps to produce friction when the match is rubbed on even a comparatively smooth surface).

If the match is a so-called "safety" match, the composition of the head is somewhat different, the chief difference being that it holds no phosphorus or compound of phosphorus, the phosphorus (the red variety, a non-poisonous substance) being a constituent of the special rubbing surface on the box or other container.

In making the matches the materials constituting the head are mixed and made into a paste with water and the sticks dipped into this to the proper depth, withdrawn and allowed to dry. The body of the

match may be of wood or paper, and the end which is to carry the head is usually first dipped into melted paraffin, stearic acid or some other easily inflamed substance. The paraffin is a mixture of hydrocarbons (compounds of hydrogen and carbon), the stearic acid, paper and wood are all compounds of carbon, hydrogen and oxygen.

The friction produced in the striking of the match develops heat enough to start chemical action among the several constituents of the head, as follows:

The oxidizing agent gives up oxygen in the atomic form (nascent oxygen) which is very active and combines with

(a) Phosphorus to form white fumes of phosphorus oxide (P_2O_3 or P_2O_5).

(b) Sulphur to produce a bluish flame and form a colorless gas of suffocating odor, sulphur dioxide (SO_2).

(c) Hydrogen to produce a colorless flame and form a colorless gas, hydrogen oxide (H_2O), which, by the way, is the gaseous form of our old friend, water.

(d) Carbon to produce a colorless flame and form a colorless gas, carbon dioxide (CO_2), the same gas which gives the "fizz" to our soda water, the lightness to our bread and cakes, and which causes the family lime water bottle to assume so unsightly an appearance, the CO_2 of the air reacting with the slaked lime [$Ca(OH)_2$] to form insoluble calcium carbonate ($CaCO_3$).

(e) Antimony to form white fumes of antimony oxide (Sb_2O_3).

Heat is developed in every one of these reactions.

The heat produced in the reactions taking place in the head vaporizes some of the wax and sets fire to it, and its flame in turn ignites the material of the stick. The carbon and hydrogen in the wax and stick unite with oxygen, the active constituent of the air, to form carbon dioxide and water, respectively. The unconsumed part of the head is a mixture of carbon and new compounds of the metals whose oxygen-liberating compounds were used in making the match head. The black part of the stick is simply unconsumed carbon (charcoal). It is seen that, while a match is, indeed, a small thing, its possibilities as a center of chemical reactions are rather great.

While we have been analyzing the chemistry of the burning match Mrs. Housekeeper has used its flame to ignite the gas of a gas jet, the oil of a kerosene lamp or the wax of a candle. Manufactured gas is generally a mixture of hydrogen (an element), hydrocarbons (compounds of hydrogen and carbon) and carbon monoxide

(CO); kerosene (often erroneously called "coal oil") is a mixture of hydrocarbons; while candle grease may be paraffin (a mixture of hydrocarbons), beeswax, tallow or stearic acid (all of them compounds of carbon, hydrogen and oxygen), or mixtures of several of these. The wicks of the lamp and candle are generally made of cotton or some other natural form of cellulose (one of the carbohydrates, or compounds of carbon, hydrogen and oxygen).

When any of these substances burn it is because the carbon and hydrogen both combine with oxygen from the air, the former to form carbon dioxide (CO_2), the latter to form hydrogen oxide (water, H_2O). In the case of the kerosene, the candle, and the gas (when burned from a flat jet), at least a part of the carbon is momentarily in the elemental state and in very fine particles distributed through the flame, and the luminosity of the flame is due to the temporary incandescence of these particles, because of their being highly heated by the energy liberated by the chemical reactions taking place within the flame. With the mantle type of burner (the so-called Welsbach light) enough air is mixed with the gas to cause the flame to have no illuminating value of its own, but the intense heat of combustion is utilized to make incandescent the rare-earth oxides which make up the mantle. Radioactivity, doubtless, plays some part in making lamps of the mantle type as efficient as they are.

In making a somewhat hasty toilet Mrs. Housekeeper uses a soap, and here again chemistry or physics, or both, come into play. Soaps that are used for cleansing the skin, particularly of the face, need not be expensive, but should be free, or nearly so, of alkali; but even so-called "neutral" soaps produce alkaline solutions with water, especially soft water. Phenolphthalein is the somewhat formidable name of a chemical which is used by chemists as an "indicator" of alkalinity in solutions. In neutral or acid solutions it has no color but in alkaline solutions it has a pronounced pink color, a few drops of a weak solution of it being sufficient to strongly color a quart of solution which is even slightly alkaline in reaction. An alcoholic solution of a neutral soap does not become colored when the above reagent is added to it, but if some of the same solution be now diluted with warm soft water it will assume a pink color. In the language of the chemist some of the soap has undergone hydrolysis (reacted with water) to form a little alkali (sodium hydroxide, NaOH) and a corresponding amount of acid (palmitic, oleic, stearic, etc., depending upon the composition of the fat used in making the

soap). The alkali is more pronounced in its action on indicators than are the acids, hence the pink color with phenolphthalein. There are differences of opinion as to whether the cleansing (detersive or detergent) action of soap is altogether chemical or physical or a combination of both. When the hands or a fabric have been grossly soiled, as with lampblack or soot, it will be found that

(a) Cold water takes off but little,

(b) Hot water is not appreciably more effective,

(c) Water in which a little sodium hydroxide has been dissolved is but little better,

(d) Water in which a little oleic acid has been placed is not at all efficient,

(e) Cold water, followed by treatment with the cake of soap to form a lather is quite effective,

(f) Soaking in hot water, followed by rubbing with the soap direct to form a lather, is the most efficient process of the lot.

Even the use of soap solutions does not seem to be as effective as the direct application of the soap to the skin or fabric. The greatest efficiency seems to be realized just when the soap undergoes hydrolysis.

Floating soaps are lighter than water because of generally containing sufficient air mixed with the soap proper to give it the desired degree of lightness. The fact that it floats makes it less elusive in the bathtub and washtub, but adds nothing to its value as a cleanser.

While we have been discussing soaps Mrs. Housekeeper has gone downstairs and lighted the gas in the kitchen range and put the coffee percolator over the fire, and, also, because this is Monday (washday) she has lighted the gas in the stove connected with the hot water tank. The burners of the gas range being near the top and hence easy of access, she has never had any accidents while starting fire in that part of it, but on one occasion she had quite a serious explosion when attempting to light the gas under the baker, and another time she had a blowup when lighting the gas in the hot water heater. In both instances she had allowed considerable time to elapse between the time she turned on the gas and the time she tried to light it, with the result that the stoves were filled with a mixture of air and gas in just the proper proportions to form a dangerous mixture, and when the flame of a match or lighted taper was brought into contact with it there was a violent explosion which in the one case blew off the lids of the range and gave her the fright of

her life. In the other case the door of the stove was thrown violently open and the force of the explosion, together with the scare she got from the burst of flame accompanying, resulted in her being thrown half way across the room and left sitting on the floor wondering what "struck her." Since then she has "played safe" and has always had a flame ready to "touch off" the gas as soon as she turned it on.

In this connection it might not be out of order to say a word or so with reference to the habit some people have of trying to hurry a fire with kerosene. The speaker does not know that there is any perfectly safe way to do this, but there is one very dangerous way to do it, and that is to pour the oil from the spout of a can into a fire in which there are no flames, but only glowing coals. The heat of the glowing coals vaporizes the oil and the resulting gas mixes with air, and the mixture may then ignite from the heat of the coals or may have to be ignited with a match. In either case very disastrous explosions are apt to ensue. Many, many good housekeepers have gone to untimely graves by the "kerosene route" and many others have been disfigured for life, while numerous homes have been reduced to ashes because someone tried to hurry a fire with kerosene. If one is careful to have a flame, as of burning paper or wood, in the stove before putting on the oil, and if the oil is dashed on in small quantities from a small cup, the danger of explosion is very much lessened, but there is still the danger of having clothing ignited from the rush of flame; so that, all in all, the process is fraught with danger.

Breakfast this morning is to consist of fruit, a cereal, fried potatoes, fried eggs, and coffee, the preparation of which for the table involve no chemical reactions which we shall stop to consider. But when Mrs. Housekeeper goes to the bread box she discovers that it is empty, not an unusual thing in many homes on a Monday morning when there has been unexpected company on Sunday. She lives too far away from a bakery or grocery to be able quickly to obtain a supply, so there is nothing else to do but stir up a batch of batter for griddle cakes, and again she is dabbling with chemicals and starting some reactions among them.

If she uses one of the more or less popular brands of "pancake flour" or a so-called "self-raising flour" she will be making use of an intimate mixture of flour (possibly of several kinds of grain), egg powder, milk powder, and a baking powder, which mixture needs

only to be moistened with the proper quantity of water or milk to be ready for baking. If the mixture was a good one when made, and has been kept dry, her chances of turning out a satisfactory lot of cakes are good, provided she does not belong to that class of housekeepers whose devotion to, and worship of, their husbands is measured by the frequency with which they set "burnt offerings" before them.

If she follows a formula of her own in making the batter she may use for leavening (making light) the mass, in lieu of a baking powder, either

(a) Baking soda and cream of tartar, or

(b) Baking soda and sour milk or buttermilk.

In either case her chances of turning out a satisfactory batch of cakes are considerably lessened, several factors contributing to the uncertainty. In household practice small quantities of powders are measured by use of teaspoons and larger ones by use of cups. There is a lot of uncertainty in measuring out teaspoonfuls, particularly if a recipe calls for heaping teaspoonfuls. What one person considers a heaping teasponful may be as much as twice that which another would use. Then again teaspoons vary considerably in capacity, and the teaspoon used by the originator of a recipe may have an entirely different capacity than the one used by the user of the recipe. It should go without saying that in measuring materials for a given batch the same spoon, or one of the same capacity, should be used throughout the process, and that as nearly as possible the heaping (if heaping is called for) should be of the same degree with all powders used.

A useful table of equivalents is

Two teaspoonfuls make one dessertspoonful.

Two dessertspoonfuls make one tablespoonful.

Four tablespoonfuls make one wineglassful.

Two wineglassfuls make one teacupful.

Two teacupfuls make one tumblerful.

Two tumblerfuls make one pint.

As an experiment it is suggested that those present tonight who are housekeepers each select one of each of the above articles from their stock, and with water see how nearly the above is true with their set. Very few will find an approximately good set.

Again, different lots of many dry powders vary in density, either because of difference in density of the particles making up the powder

or because of differences in packing (loose or shaken down), so, while a teaspoonful of one lot of baking soda, for instance, may be just enough to neutralize a given bulk of cream of tartar or sour milk, the same bulk of another lot may be either too much (if the powder is dense) or too little (if the power is light) for the purpose intended. If too much, the end product (the cake) may have a decidedly disagreeable alkaline taste, as the excess of baking soda when heated, as in baking, is decomposed in part, with the formation of sodium carbonate, a common commercial variety of which is known as washing soda. If too little, the cakes may taste sour because of the unneutralized cream of tartar or sour milk. This latter condition is to be preferred to the former, as the sour taste is less objectionable than the alkaline taste, and can be more easily masked by the taste of the butter and syrup with which the cakes are usually eaten.

Buttermilk and sour milk vary in degree of acidity with different lots, so their use makes the cake process even less certain of successful outcome than where cream of tartar is used. The first cake off the griddle may be sour, in which case Mrs. Housekeeper usually decides to add more baking soda to the remaining batter; or the cake may be bitter, in which case she adds more sour milk. In either case she has to guess at the amount to be added. If she adds soda she first mixes it with water and stirs the solution into the batter; if she adds more sour milk she is adding water (milk being mainly water); so, in either case she is making the batter thinner (perhaps too thin to hold the leavening gas), and, in mixing, she is stirring a lot of gas out of the mixture. Result, a watery, thin, flabby cake which tries the patience, possibly, of an exacting selfish husband, and sometimes results in a verbal explosion on his part which may constitute the first step of a journey to the divorce courts.

Some housekeepers have the mistaken idea that the sole reason for using baking soda with sour milk or buttermilk is to neutralize the acidity (sourness). If that were the case sweet milk without baking soda would be preferable. The acid of the milk (chiefly lactic acid) decomposes the baking soda (sodium bicarbonate) with the liberation of a gas (carbon dioxide) which puffs up the mass in which it is formed, even in the cold, but particularly when the mass is heated (heat expands all gases). The neutralization of the acid is only incidental. For this reason it is bad practice to mix the soda

with the sour milk and thus run the chance of losing most of the desired gas. Much the better plan is to mix the soda, flour and other dry ingredients thoroughly, generally by putting them through a sifter several times, mixing this with the water or sweet milk called for by the recipe, and adding the sour milk or buttermilk the last thing with only enough stirring of the mass to ensure the even distribution of the latter through the mass. Too much stirring disengages a lot of gas from the batter and lessens the chances of the baked cake having the desired degree of lightness.

A baking powder consists of an intimate mixture, in correctly balanced proportions by weight, of baking soda (sodium bicarbonate, $NaHCO_3$) and some other substance (usually acid in character) to react with it to liberate carbon dioxide (CO_2) gas, together with starch as a diluting material. All the materials should be dried thoroughly before mixing, and packed in containers of such character as to ensure the mixture being kept dry until used. So long as no water comes into contact with the mixture there is no reaction between any of its components, but when it is stirred into water or milk or mixtures containing water the soda reacts with the other active ingredient to form the gas above mentioned (carbon dioxide), the formation of this gas being the sole useful function of a baking powder. To ensure a maximum degree of lightness in a cake or biscuit from a minimum quantity of baking powder, the powder should be mixed with the flour and other dry ingredients and the water, milk or thinning liquids added last, stirred in quickly so as to form at once a relatively thick batter which will hold the gas. Recipes which call for both baking powder and baking soda are scientifically wrong, unless they also call for some other ingredient of an acid character. While it is true that baking soda alone imparts lightness to a mass, it forms (as stated earlier in this paper) washing soda with its strongly alkaline taste and character; hence it should be used only when there is some other substance present which reacts with it. The speaker has seen recipes calling for cream of tartar without baking soda or other neutralizing agent, and fails to see any chemical reason for such use. It certainly cannot produce lightness in the mass and it has a sour taste (not very pronounced, it is true).

The taste of a cake or other product, in the making of which a baking powder is used, depends in considerable measure upon the character of the products resulting from the reaction between the

several active ingredients of the powder. The carbon dioxide, being gaseous, is probably all driven off by the heat used in baking, but each powder leaves in the baked product some one or more non-volatile compounds which may or may not have a pronounced taste, coverable or not by the flavoring agents in the product, or used with the product when it is eaten. Let us look into this phase of the subject.

Alum baking powders contain as active ingredients, sodium bicarbonate ($NaHCO_3$) and some one or more of the aluminum alums [$AlK(SO_4)_2$, $AlNH_4(SO_4)_2$, $AlNa(SO_4)_2$]. When these react they form aluminum hydroxide [$Al(OH)_3$] a tasteless substance (because insoluble in water), sodium sulphate (Na_2SO_4) a readily soluble salt with pronounced disagreeable taste (this substance is sold in the drug stores under the name of Glauber's salt, or horse salt). In addition, potassium sulphate K_2SO_4 is formed when the first alum mentioned is used, and ammonium sulphate $(NH_4)_2SO_4$ when the second is used. The taste of these is not as pronounced as they are less soluble in water than is the sodium sulphate.

Tartrate baking powders contain as active ingredients, sodium bicarbonate and cream of tartar (potassium bitartrate, $KHC_4H_4O_6$), or tartaric acid ($H_2C_4H_4O_6$) or both. The non-volatile residue is either potassium and sodium tartrate, $KNaC_4H_4O_6$ (sold in the drug stores as Rochelle salt), or sodium tartrate $Na_2C_4H_4O_6$, or both. The taste of the product is not so pronounced but that it is generally well covered by the flavoring materials of the cake or its dressing.

Phosphate baking powders contain as active ingredients, sodium bicarbonate and either mono-calcium phosphate [$CaH_4(PO_4)_2$] or monosodium phosphate [NaH_2PO_4]. In either case disodium phosphate (Na_2HPO_4) with a rather pronounced taste is formed. Where the calcium salt is used there is less of the disodium phosphate formed, some of the phosphate radicle going into the formation of tricalcium phosphate [$Ca_3(PO_4)_2$], a tasteless substance because insoluble.

It may be noticed that most of the soluble substances named are laxative or cathartic in physiological action (depending upon the amount taken), but the amount present in a plate of griddle cakes or a piece of sweet cake would not ordinarily be sufficient to produce any appreciable effect on the eater. However, if little Johnny knew this he might insist on substituting cake for castor oil on those occasions when mother imagines he needs medicine of that kind.

The speaker once knew a man who insisted that his wife put Epsom salt into her buckwheat cake batter. He never heard whether or no the wife and children of this man cared particularly for buckwheat cakes.

Baking ammonia, sometimes called hartshorn, but generally sold as ammonium carbonate, though only in part a carbonate, is used in the making of some kinds of cookies. When it decomposes in the baking process it liberates both ammonia gas (NH_3) and carbon dioxide (CO_2) gas, both of which tend to give lightness to the cookies and then disappear, leaving no solid residue in the cake, a desirable thing.

Occasionally one finds a recipe for cake (Angel's food, for instance) in which no leavening agent is mentioned. In such cases there are usually to be used large quantities of egg white which is to be thoroughly whipped. In the whipping process large quantities of air bubbles are enclosed and when the cake is being baked the desired lightness comes from the expansion under the influence of heat of these air bubbles.

Well, breakfast is over and Mr. Housekeeper and the children have gone for the day, the former to his place of business, the latter to school; all of them happy if the cakes were good, or sulky if the cakes were bad. Mrs. Housekeper now turns to the task of clearing off the table and washing the dishes. If she has a supply of hot rain water or other soft water, the cleansing of chinaware and glassware offers little difficulty, as only a little soap is needed to aid the water in loosening the foreign matter, even grease, that sticks to the dishes, aided generally by gentle rubbing with a cloth or brush. The brush is the better as its use makes it possible for the dishwasher to go through the process without having her hands in the dishwater an undue length of time, with all that that means to a sensitive skin. Dishes which had contained pickles and other materials of an acid character should be rinsed in clear water before being brought into contact with soap or soapy water, as the acid (generally acetic) of vinegar decomposes soap to liberate, among other things, the fatty acids of the soap, which are greasy and stick to china and glass.

As the dishes are taken from the wash water they are set on edge in another pan or on a rack which can be lifted out of the pan, and hot water is poured over them to rinse off the adhering soapy water. If the water is hot enough and soft and the draining is properly done there will be little or no need for drying towels, except,

perhaps for the glassware, and then chiefly for polishing. Soft water leaves no residue and the heat of the dishes is generally sufficient to effect the vaporization of the last traces of moisture.

If the water is a river water, a well water or spring water, it is apt to be "hard"; that is, it will likely contain certain substances in solution (generally salts of calcium or magnesium) which react with soaps to form insoluble calcium or magnesium soaps of the acids of the soap used, these being sticky and adhering easily to dishes or fabrics with which they come into contact, and often forming curdy precipitates in the water in which they formed. These deposits are not soluble in hot water, hence cannot be rinsed off. Besides, the mere evaporation of such hard waters leaves a deposit which is easily visible on glassware and may be sufficient to dim the lustre of chinaware. The use of drying towels, or polishing towels, at least for glassware, becomes a necessity, for reasons of fastidiousness, though not necessarily for sanitary reasons. From a sanitary point of view air-drying of dishes is far more desirable than cloth-drying.

The problem of keeping metallic tableware in a presentable condition is one which has given Mrs. Housekeeper considerable concern. Silverware, whether plated or solid, nickel-plated ware, German silver (which, by the way, is not silver at all but an alloy of nickel, copper and zinc), steel, and even aluminum, all tarnish—lose their lustre and very often turn yellow, brown or black. The tarnish on silver is usually silver sulphide and may be caused by a number of things. Eggs and certain vegetables (cabbage and similar vegetables) contain organic sulphur compounds which, as the material becomes old, or often when it is being cooked, decomposes, giving off, among other substances, hydrogen sulphide (H_2S), often called sulphuretted hydrogen. Most coal contains sulphur compounds which, under conditions of imperfect combustion sometimes yield this substance and often it finds its way into the atmosphere of the home. It is a gas possessed of an odor which no sane person would suggest as a basis of perfumery, and it attacks the surface of many metals, particularly silver and copper and alloys containing them, charging them superficially into sulphide which is usually dark and lustreless. The chances for considerable quantities of the gas getting into the air of the home and remaining there are much greater in winter than in summer, and so it is that silverware requires polishing oftener during the cold months than during the warm ones of midsummer. The odor of boiling cabbage is in part due to this gas,

and the tarnish imparted to silver spoons when used with eggs, particularly when said eggs are not strictly fresh, is also due to it.

Silver and other smooth metalware may be, and generally is, cleaned of tarnish by use of polishes and pastes containing a so-called abrasive—something which mechanically rubs off the tarnishing film. For silver and other relatively soft lustrous metals nothing should be used that is gritty. Emery, pumice, sand and sandsoaps, steel wool, are all too hard and scratch the surface of the metal. Chalk, china clay and rouge (a special form of iron oxide) are most generally used, sometimes with a grease base, sometimes with water, sometimes with ammonia water. Every time metal tarnishes a thin film of its surface is changed to sulphide or some other compound, and each time it is polished or cleaned this compound is removed and, where mechanical polishes are used, almost always, if not invariably, some of the underlying metal is also removed. This explains why plated ware eventually shows the baser metal which makes up the body of the article, particularly on the edges. The oftener such ware is polished the sooner will the baser metal show. Even so-called "solid silver" (which, by the way, is not pure silver but an alloy of silver and a harder metal, generally copper, "Sterling silver" being ninety-two and one-half per cent. silver and seven and one-half per cent. copper) gets thinner with each trip through the hands of the polisher.

Occasionally one meets with a silver polish which contains potassium or sodium cyanide. They seem to be very effective but they not only remove tarnish but some of the silver underneath, and, besides, these cyanides are intensely poisonous, hence dangerous for the laity to use.

Perhaps the most satisfactory process for cleaning silver is that involving the use of the "silver clean pan," in which, by chemical means (electrolytic) the silver compound which is the cause of the tarnish is decomposed with the formation of metallic silver, while there is no evidence that any of the other silver of the article is removed. The pan may be an ordinary aluminum pan, or it may be an enameledware pan with a sheet or grid of metallic aluminum covering the bottom. The tarnished silver articles are so placed as to be in contact with the aluminum and covered with a solution of salt and baking soda in water, and then heated. A tablespoonful of salt and a teaspoonful of baking soda to each quart of water works very nicely.

Mrs. Housekeeper has quite a collection of aluminumware among her cooking utensils and has found this metal very satisfactory for most purposes. She has learned by experience that there are some things which she dare not do with it—that she dare not put strongly alkaline solutions into it, that hydrochloric acid attacks it quickly, and that it is not altogether immune to the action of vegetable acids. She does not wash it with strong soaps and she does not use soap powders and similar preparations on it, as these destroy its lustre and leave a deposit on it which readily takes up colors from colored fruits and vegetables. When she wants to polish it she usually uses steel wool, and when she wants to remove stains from its interior she is usually able to do so by putting into it some water and a little vinegar and boiling the mixture.

The dishes out of the way and the water in the boiler being hot, Mrs. Housekeeper begins on the weekly wash. In sorting over the various soiled articles she finds a tablecloth with coffee stains on it, a napkin with fruit stains on it, a handkerchief with writing fluid on it, another napkin with several iron rust spots on it, another handkerchief with blood spots on it (Johnny had had the nosebleed), and a soft collar with iodine stains on it (father had "doped" an incipient boil with iodine and got some on his collar). These all demanded separate treatment before she dared put them into the tub with the rest of the "white clothes." She removed the blood stains by washing them thoroughly in cold water, the coffee and fruit stains by pouring scalding hot water from a height onto the stained fabric stretched over a bowl, the iodine stains by treatment with a solution of sodium thiosulphate (commonly called "hyposulphite of soda"), the iron rust and writing fluid stains by treatment with a solution of oxalic acid followed by treatment with a solution of chlorinated soda (Labarraque's Solution, sometimes incorrectly called "Javelle water") made from "chloride of lime" and washing soda. Sometimes she uses lemon juice and salt to remove iron stains. When stains are on colored goods Mrs. Housekeeper knows that the chemical which removes certain stains may also remove certain colors from the goods, so she always tries it first on an inconspicuous part of the fabric before "going after" the stain proper.

Mrs. Average Housekeeper is not fortunate enough to have a supply of naturally soft water with which to do her washing, else she could do satisfactory work with almost any good laundry soap. The water supply in her home is not even temporarily hard water,

else merely boiling it would decompose the acid carbonates which make it hard, and the normal carbonates, being insoluble in water, would give her no trouble; but the water she has to use is permanently hard (contains calcium and magnesium salts, generally of sulphuric and hydrochloric acids, which are not decomposed by heat). These, as stated earlier in this talk, react with soap to form insoluble soaps which curdle the water solution of soap, the clots adhering to the clothes and the sides of the tub, and very often form nuclei upon which is deposited bluing from the rinse water, forming spots on the clothes. She has found that she can neutralize the effects of the substances which make the water hard by putting some washing soda (salsoda) into the water before she puts any soap into it. Washing soda is sodium carbonate (Na_2CO_3) and has the property of reacting with calcium and magnesium salts and converting them into water-insoluble carbonates, thus rendering them inert. It is cheap and there is nothing better for the purpose. Many of the water-softening powders on the market under more or less fanciful names are chiefly this substance with occasionally some powdered soap mixed with it. It is cheaper than soap and has some detersive action of its own, and has little or no effect on the strength of cotton and linen. However, neither it nor any other alkaline material should be used on wool or silk, as alkalies have a strong tendency to destroy both kinds of fiber (especially silk) and are claimed to bring about shrinkage in woolens.

Many laundry soaps (only yellow ones, however), are in part a sodium resinate (because made in part from rosin) and these usually lather very freely, making an abundant suds which is very effective in loosening dirt. So-called "naphtha" soaps rarely contain enough naphtha, particularly after they have been stored a while and allowed to dry out, to warrant their use in preference to any other good soap. Some people imagine that a little kerosene or turpentine oil (spirits of turpentine) added to the wash water, or more frequently to the water in which white goods are to be boiled, is of value.

There are differences of opinion among housekeepers as to the value of "boiling" clothes with strong soap solutions, some claiming that it tends to keep them white, others that it does no good. Several things are to be said in favor of the practice. The hotter the solution the greater the degree of dissociation on the part of the soap and the greater the amount of suds, which has the property of loosening dirt; and boiling certainly sterilizes the articles boiled. Mrs.

Housekeeper has a good wringer and sees to it that the rolls are close together when she uses it, thus ensuring the squeezing out of the most of the soapy water from the articles before they are put into the rinse water. She has also learned that hot water removes soap better than does cold water and is not so uncomfortable to work in with her hands, so she always has her rinse water quite warm. She is one of those who uses a little bluing in the rinse water for the white clothes, knowing that it has a tendency to neutralize slightly yellowish tints; but she has found that some blues on the market are worse than none at all—that unless clothes once blued with them are thoroughly rinsed in clear water before being put into soapy water (the next time they are washed, for example) the blue adhering to the fabric is changed by the alkali of the soap into a yellow compound which is harder to cover up with bluing than was the original slight yellow tint, and the continued use of such a bluing makes the clothes so yellow that they have to be bleached by special process if they are to be considered as being white. Mrs. Housekeeper will have nothing to do with any bluing that loses its color and assumes a yellowish or brownish tint when a solution of it in water is treated with either ammonia, washing soda or strong soap.

Besides using only neutral soaps with woolens Mrs. Housekeeper takes care not to rub them on washboards or tumble them about very much in washing machines. She knows that wool fiber has a lot of barb-like projections on the surface and that these have a tendency to make adjoining fibers mat together when rubbed together when wet, and that these barbs do not allow of the threads stretching out fully again. She also believes in the practice of washing and rinsing woolens in water as nearly as possible of the same temperature, as tending to prevent shrinkage.

When she can do so Mrs. Housekeeper always arranges to hang her clothes on the line to dry in such a way that the white clothes shall be in the sunlight and the colored clothes in the shade, the former to get the bleaching action of sunlight, the latter to avoid it.

Mrs. Housekeeper having "hung out the clothes," put away the tubs, etc., and mopped the floor where she had been working, retires to her room to rest for a time before preparing dinner; and we, being somewhat tired ourselves from following her about, will leave her there, with the hope that the rest of the family, when they come home, will realize what a hard day she has put in and will be ready to excuse her if she does not have quite as fine a dinner ready for them as she usually has on other days of the week.

THE UPS AND DOWNS OF NITROGEN.*

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It is an unwise preacher who commences his sermon with an apology for his choice of a text—although we have all listened to sermons where an apology was quite appropriate, not only at the beginning but also at the Amen. Yet for sedative purposes it is now publicly announced that the grammar of this title is not the most fortunate, and with due deference to that bewildering and bewildered crowd of cross-word puzzle devotees, the title is hereby changed to "The Verticals and Horizontals of Nitrogen."

This element, Nitrogen, discovered in 1772 by Rutherford, is one of the most peculiar of the elements constituting the periodic table. Of the great group sitting at this elemental banquet table none is more eccentric than this gas called Nitrogen. There is not an adjective in Webster's that is not or can not be properly applied to this erratic element at some time or another. Antonyms and synonyms come in complicated pairs to describe its queer eccentricities. Inert and active, fettered and free, toxic and tonic, worthless and worthy, devilish and demure, vagabond and docile—all fit into the various whims and fancies of this most versatile of the silent builders of the universe. It is the Dr. Jekyll and Mr. Hyde of fact—among the elements.

And indeed it is because of its versatility and its complexities of conduct that it will be difficult to do aught this evening but consider a few phases of its endless story.

Nitrogen was born in the Kingdom of Infinity, a long time before the creation of Adam. That is obvious for it was one of Adam's several ingredients. Who or what its progenitors were is not clearly known, for its name is not mentioned, even in that long genealogy in Genesis. A hint has been dropped, however, by the Darwinian chemists of today, who claim it to be a lawful son of Hydrogen. As a matter of fact it seems that Hydrogen will eventually prove to be the Abraham of all the elements. At least it ap-

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pears when we brush out the heap of heavy words—isotopes and emanations and gamma rays and the like—the master design in the pattern of the element is always the hydrogen sitting in positive comfort on the throne of every atom, whether that atom be lead or gold or nitrogen. Thus what we actually know of the origin and geneology of Nitrogen is as accurate and trustworthy as the lineal chart of John Jones or William Williams.

It is nevertheless very interesting to note that the modern physicist has exploded for all time the honored concept of the changelessness of the element, of the eternal integrity and independence of the fundamental substances. But while the element is no longer immutable—the old law of the indestructibility of matter still reigns unquestioned.

The atmosphere about us is roughly composed of one-fifth oxygen and four-fifths nitrogen. Of course there are many things in the air other than these. The composition of the atmosphere is as heterogeneous as that of sea water. There are the rare gases—helium, neon, krypton, niton, argon, and many others—then the transient end gases of combustion and other indescribable emanations—there are the limitless armies of germs that travel their invisible ways in search of roosting places—the air in truth is full of polluting things, and fuller today than ever, and probably more polluted since in addition to its regular impurities the radio has come with its jazz and its kindred sophistications.

Yet the gross character of the air is fairly constant. Thus it is assumed that when Jacob wrestled with the Angel at Bethel and thereby raised the tension of his alveolar air—the atmosphere there was even as it is today—four-fifths of nitrogen and one-fifth oxygen. This evening in Philadelphia we breathe the same air that millions who are now in dust have breathed before, and the millions who will follow us will again use this nitrogen that we unwittingly, at every expansion of the lungs, draw in and empty out again with every expiration.

In other words the nitrogen which we breathe is not directly used in any sense in our bodies. It comes into our lungs through our noses, stays in awhile, looks around and goes out again exactly as it entered. And instead of being able to use this nitrogen, which is as free as raindrops in April, when our bodies need nutritional nitrogen we go out to the delicatessen shop and pay 85 cents a dozen for eggs embalmed by experts. The oxygen which goes to

the lungs with it of course attends to its several businesses—but nitrogen, the lazy, is only a silly wanderer.

Now, one might ask, what good is this atmospheric nitrogen if it is inert, inactive and unconcerned, incapable of assimilation by plant or animal? Our answer is a question. What good is ballast to a plying vessel or sand in the ascending balloon?

Let oxygen alone be breathed in our lungs and our fires would burn so fiercely that the furnace itself would crumble. Oxygen indeed is a supporter of combustion and the quintessence of vitality, but unless diluted with the inert, inexplosive, harmless nitrogen, it is a vile poison.

Then one might ask why it is that this free Nitrogen insists on remaining "up in the air" all the time. Again we counter with a question. Why does Ivory Soap float? The manufacturers say it is because of its purity—we know it is because it is lighter than water since it is composed of a great deal of air surrounded by a little soap.

So nitrogen is up in the air because as long as it remains Nitrogen its density is such that it cannot help but float in the ethereal spaces.

It must not be assumed, however, that Nitrogen's contribution to the scheme of existence is merely its ballasting or diluting properties, for besides its occurrence in the free and inert state in the atmosphere, a small amount of it actually comes to earth—and circulates in inorganic and organic nature. This bringing of Nitrogen to earth is effected by Nature in several ways, all of them designed to hang something heavy on to the Nitrogen and so force it down by sheer gravity.

To the operation of living processes, to the growth of plants and animals, this nitrogen of earth is vastly more significant than the nitrogen of the sky. For without its circulation the earth would be barren of vegetative or animal life. It is indeed an essential part of all vital processes.

Peculiarly enough, however, Nature has been most conservative with her supply of these Nitrogen compounds in and upon the earth, for she knows how difficult it is to keep combined nitrogen behaving properly, and so rather than be bothered with it in quantity she wisely uses a "shift" system that keeps a small force of it busy all the time. Of all the merry tricks displayed by Mother Nature, none

indeed is more fascinating than her method of handling the nitrogen compounds.

Scientists of course have to give this scheme of hers a special title, so they call it "The Nitrogen Cycle" or Circle.

Now, it is very hard to know just where to break into a circle—whether it be a social, a sewing or a scientific circle. There are no protuberances upon which to hang—and if the circle is in motion one is so apt to go off at tangents and forget to come back. It is pardonable, then, if, in trying to get on this merry-go-'round of Nature's, we have to run with it in the same direction, and perhaps about it several times before we can finally find some place of entry.

First of all let us understand two things very distinctly. Number one—the Ups of Nitrogen. Inactive, inert, ballasting, diluting—Nitrogen of the air. While in the air it is of little use, though filled with possibilities.

Number two—the Downs of Nitrogen, the compounds of Nitrogen. This is fixed nitrogen, nitrites, nitrates, ammonia, protein, etc., not up in the air, but in and upon the earth—vitally necessary to the welfare of the earth's energy, space and time binders—namely, the plants, the animals and human beings.

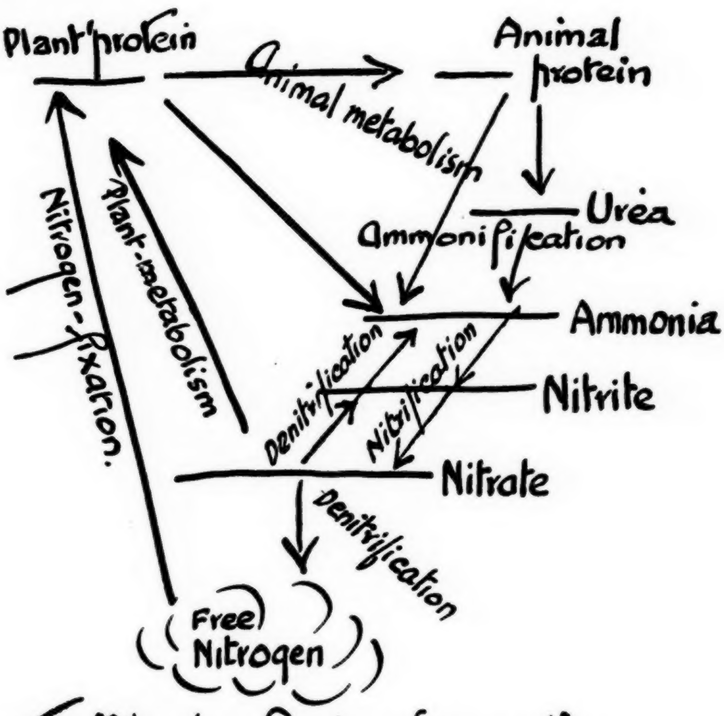
Let us now try to break into the circle like this: Teacher told us many years ago, and it must have been true for it is still being so taught—that in the human diet are three necessary components, namely, fats, sugars and proteins. These three and all three must constitute food if the fed is to survive. The last named (protein), is a complicated nitrogen compound. It forms part of our food because it forms a large part of our body structure. Out of it are knit the fibers of our muscles, the plasma and cells of our blood stream, the substance of our nerves and brain.

But the muscles and blood and nerve and occasionally the brain are constantly wasting their substance through action—and this wastage must be repaired by new construction. That in part is where the protein of our food must go, and that is why protein in food is so vitally essential.

Animals and some plants contribute to man this necessary part of his diet. Man of course is the elect of earth—he says so himself—and everything in and upon its surface was put there for his especial welfare, and so these things are only a matter of course.

The lean meat of animals, the nitrogenous portions of plants and vegetables, milk, cheese, albumen of eggs and other commodities

furnish man with this valuable protein. But where do the animals and plants get it? We are still on the trail of the cycle. The animals get their nitrogen by eating the plants, that is one reason why a cow is contented, for it eats conscientiously so that it can function well as a milk, butter, cheese and meat factory for the benefit of mankind.



The Nitrogen Cycle (squared!).
Showing the transformations Nitrogen undergoes in Nature.
From Conns' Bacteriology

The plants, then! Where do they get the nitrogen? For let us continue to remember that life even in the plants cannot go on without these nitrogen compounds. Out of the sky and out of the soil—that is where plants, the energy binders of the universe, withdraw their vital nitrogen.

The commuter generally regards his little garden back of the house with more affection than information. To his sweet state of unconcern the soil that covers the surface of his 20 x 20 plot is a sort of an anchorage for pansies and poppies, lettuce and radishes. A sprinkle here of radish seed and a dash of lettuce there—then a little water now and then, and out of the mud comes the huckster's wagon.

This does not apply to a certain resident of New Jersey who was recently asked why he did not make a vegetable garden. His reply was that he preferred to depend on his huckster for his vegetables, for when this person was asked for beans he never gave Jimson weed instead.

But the soil is more than an anchorage for plants. For it feeds them the vital nitrogen. That is part of its contract.

But where does the soil get its nitrogen compounds? That indeed calls for a complicated answer, although it is still within the cycle that we shall find it. Into the scheme now enters the tiniest agent of all, the ever-present microbe.

Plants call to their assistance a great variety of microbes for this business of garnering in the nitrogen. And these germs work their mysterious ways in several types of service. There are all kinds of bacterial sub-contractors in this job of building the elemental blocks of nitrogen into the larger inorganic compounds which the plant needs for its laboratory. One special squadron of bugs will capture free nitrogen from the air, treat it in some mysterious manner and quietly turn it over to the plant, no longer the lazy nitrogen but a working agreeable compound.[1] Another wrecking crew of germs will take in charge a fallen leaf or branch or a dead bug or a dead man or a fallen tree trunk. For they all spell alike to the germs. Slowly but surely they will tear it apart, reducing its complicated nitrogen compounds to useful and usable substances which the living plant can use. Nature has no use for dead organic matter.

Her germs are always on the job disposing of worthless carcasses. The only way to stop her is to fill the carcass full of something of which the germs are afraid. That is why the embalmer tem-

[1] These symbiotic germs, so called because they enter into a business partnership only with those plants that suit them. Thus the leguminous plants, peas, beans, etc., are especially fortunate in that these germs of nitrifying especially favor them. And these full-grown legumes soon grow rich in nitrogen, hence the fertilizing value of cow peas.

porarily frustrates decomposition by filling the corpse with formaldehyde.

In the soil these hordes of microbes all have their special duties to perform. Nor would one of them depart from its conventional activities. Each has its special work to do and a nitrifying bacterium would no more think of doing else than nitrify any more than a Philadelphia union plasterer would fix a leak in the cellar.

Between them, however, they manage to take nitrogen from the air, out of decomposed nitrogenous tissue, out of decaying plants and animals, and they build it half way or tear it down half way, into a fixed and useful nitrogen compound, just right for the plant's metabolism.

In its own laboratories, then, the plant builds these compounds furnished by the germ or other source into the complicated molecule of protein which directly by way of the earth or via the cow or chicken gets into the constitution of man who seems to be the center of the circle or cycle. And man must not draw too much inferential comfort from this peculiar story that seems to place him high in Nature's estimation. For Nature, after building this intricate cycle especially for man's benefit, claims as part of her relentless scheme the very being for whom her cycle operates.

Let Life desert this fragile human temple, rot and decay soon start their decomposing work. The germs of putrefaction are no respecters of persons and a kingly shroud deters their wrecking enterprises no more than the beggar's coverlet. The silent dissolution of the material flesh proceeds with equal regularity and relentlessness in Potter's field and in the marble vaults of Croesus.

Nature demands again the ingredients that she loans to the soul's repository, and she is more anxious about her fixed nitrogen than any part of the carcass. Of course every atom of the body is put to another use. Let none of my listeners be misled into thinking that death is the end of even material things.

"There is no death.
The dust we tread
Shall change beneath the summer showers
To golden grain or mellowed fruit,
Or rainbow-tinted flowers."

Personally this soliloquy affords me no regret. I hope in her scheme of things that Nature does with my atomic residues what

the poet intimates so beautifully. I hope the wrecking germs that take over the job of disintegrating my carcass do their job right and return all my nitrogen into active circulation again. Only I hope that daisies and not nettles will have the benefit of it.

May I pause here to remind you that this great process of exchange which goes on and on eternally has in it much that urges meditation. For example, is it appreciated that the luxuriance of growth in the cemetery is due to the fertilizer planted there in serried rows, the decaying bodies of the silent sleepers?

Is it appreciated that the sweet geranium that grows on a loved one's grave mound is actually part of the body that lies then beneath it? Is it appreciated that cremation is a crime? For those who burn their dead are robbing the earth of much potential fertilizer. If cremation was universal the earth would lose each century practically twenty bodies to every square mile of surface area. It is right to believe that such a procedure would have considerable effect on the fertility of the soil in a few millennia more or less.

Nor is this bacterial army and plants the only instruments which Nature uses to produce and keep in circulation her Nitrogen compounds, for there are additional factors at work. Atmospheric electrical discharges cause the nitrogen and oxygen of the air to lose their usual incompatibility in the shock of the explosion. In the presence of moisture they become companionable and join hands, forming a mutual association known as ammonium nitrate, which is conveyed to earth wrapped up in raindrops.

Then the plants themselves, so we are told, by a process of surface evaporation form small amounts of a fixed nitrogen compound called nitrite of ammonium.

Another source of available nitrogen compounds is in the bodies and in the excrements of animals. In the animal economy the protein nitrogen which enters into the diet is not all used in the construction of new tissue and repairs, and much of it passes out of the circulation with some of the nitrogen unused, although greatly simplified. The presence of these simplified nitrogen compounds in the dead bodies of fish and other creatures and in manure and other animal excrements account for the use of these materials as plant fertilizer. Human urine contains a large amount of urea, which is a simplified nitrogen compound very close to the inorganic kingdom. The value of animal manures, loam, vegetable mould, marl, decayed animal material, etc., has been recognized long before our re-

corded history. For even the poor Indian knew that a dead fish stuck in the corn hill gave him a better crop of corn. That it was the nitrogenic substances present in these manures and moulds which gave them much of their plant food values was not known, however, until recently.

In England, in 1669, Sir Kenelm Digby suggested in place of manure the use of saltpeter, which he said constituted the valuable part of manure. Liebig, of extract of beef fame, was, however, the chemist who first really brought to light the true principles of fertilizer practice, and he demonstrated in 1840 that certain chemicals, notably the nitrogen compounds, phosphates and potash salts, were equally as good, if not better, than manure for fertilizing barren soil.

Dr. Slosson, in his wonderful book, "Creative Chemistry," is responsible for the statement that people laughed at Leibig and transferred the syllables of his name when he said that some day the world would have a nitrogen famine unless some way was found to use the nitrogen of the air to feed the crops that were essential to the earth's necessary hordes.

At the present time this country alone produces more than five billion bushels of grain each year. Each bushel of grain needs nearly a pound of nitrogen for its growth. This means that the soil of the land loses annually to its crops about two and a half million tons of nitrogen compounds. This loss must be made up by using fertilizer or by planting leguminous crops, or the soil will inevitably become exhausted and fail to produce our food.

As if storing up for a day of dearth, Nature had quietly banked quite a vast accumulation of this treasured useful nitrogen compound in the form of excreta in a most remote quarter of the earth. Off the coast of Peru lie the Chincha Islands, one of Nature's Nitrogen Banks. Here for countless centuries great hordes of silly-looking birds, the penguins and pelicans, and other birds of the sea, have lived in a most insanitary way. Their filth and excrement have accumulated through these untold ages until some of the deposits have reached heights of almost two hundred feet. Later similar guano piles were discovered on the mainland of Chile and Peru.

It is interesting to know that in certain guarded islands upon this coast annual accumulations of guano continue to occur to the extent of about 50,000 tons. One dabbler in useless arithmetic figures that it requires the digestive equipment of four million

pompous penguins or a like number of pensive pelicans to deposit this vast accumulation.

Fixed nitrogen in the form of sodium nitrate, so-called Chile saltpeter, constitutes the great portion of these accumulations. These stores had been made possible because of the lack of rain in that part of the world, thus the soluble nitrate had not been washed away into the sea where most solubles finally go.

But once this bank was discovered man promptly went to looting it, for his children had multiplied so rapidly on this earth that the soil which nourished his crops was sadly in need of nutrition. He also had need of it in the business of fighting. What was put in the ground was caught in the swirl of the cycle, but the nitre that was shot out of guns went back to its freedom and inertia again.

Gunpowder, smoky and smokeless, are all forms of combined nitrogen. With every shot from a firearm life is destroyed, whether the bullet or shell strikes its victim or not. As previously mentioned, no life is lost by the death of the individual, for out of the dissolution of the body new life arises. But the shot of the gun releases, each time, a vast amount of free nitrogen, which disappears into the air and inertia again. There is a diminution each time in the capital of fixed nitrogen, and it is upon this that the total number of living beings actually depends. Then the burning of the forests and the ammoniacal decay of organic materials also scatter much of the fixed nitrogen back into its state of freedom. And so the rotation of Nitrogen in Nature goes on eternally. And what a romance could be woven out of just one chapter of this everlasting exchange. Listen to this fragment from the autobiography of an atom of Nitrogen:

"For many years I roamed in delight out in the high ethereal spaces, my twin atomic brother ever flying by my side. We had always been warned not to get too close to what father called the Region of the Noisome Light, because it was said that freemen were there made slaves. Religiously we kept away for many atmospheric æons. One day, however, an argon molecule who had been to the Region and back, delighted us so with his story of wonders and wonders, that we both quietly decided to go there. And silently riding a globule of water we stole away one day to the Land of the Terrible Flash.

"But oh! the sadness of it then, for even on the very boundaries of that terrific region there flashed the most ungodly sheet of fire,

followed by a crashing noise the like of which I had never heard before. Long ago my brother Atom and I had sat on the edge of a Lunar Crater when it spouted a column of fire and smoke, and what a noise that was, yet it was but a swish of an angel's wing to the thundering clamour of the Land of the Noisome Light. And what a confusion—millions of other atoms like ourselves—for we were not the only sons of Nitrogen who had ventured to explore—and none seemed to know where to go or what to do. My brother was only a moment since grasping my hand for assurance. After the flash he was nowhere around, and vainly I cried and hallooed for him. Then came another flash, worse than the first, and a noise like the crash of a thousand falling stars.

"For the first time in my life I was hopelessly lost. Blinded by the white light and deafened by the splitting noise, I groped about for company. In the dismal darkness I grabbed the next one to me, and not content with one I grabbed another. But when senses lost their bluntness once again I learned my sad predicament. No longer a freeman, wielding a will of my own—knight of the sun-light ether—I awoke to a sense of bondage.

"Oxygen—the hateful, hated son of a laborer—held me doubly captive. Nor had I my wonted confidence or capabilities. No longer could I sit on the back of a raindrop and guide it wherever I would, but I seemed now to sink and be enthralled by it—and I recall how, enveloped in water and tied to the oxygen, I tumbled to another far land, which I now know as the Planet of Earth. This Earth, I find, is spoken of in its own books as the favored of the Lord's handiwork, yet the Chamber of Commerce in Mars only refers to it as an insignificant, lightless star infested with two-legged insects.

"I had no idea in my mind except to get back home to my brothers, no matter what road would occur. So, with this notion always in my heart, I splashed with the raindrop into the sea off the coast of the land called Norroway. Something instinctively told me then to keep on the right side of green-colored beings, and surely enough, as I approached a tall columnar creature, swaying in the off-shore winds and waving long white arms into the pulsing sea, I felt an irresistible impulse pervade my being—and I was drawn into the embrace of this, a Fjord sea grass.

"But you can imagine my sadness then, upon finding that this meant for me a much more certain imprisonment, for in addition to my bonds of oxygen the plant which they call the seagrass added

to my captors a host of other cruel atoms. There was hydrogen and carbon and phosphorous—nasty, disagreeable, unrelenting captors, and in the plant's metabolism I was only one insignificant member of its chlorophyllic content.

"Then the sea one day became angry, and threw ragged stones and sharp pieces of sand at the green plant where I was imprisoned. The blade of grass where my cell was fell before its onslaught, right

into the seething waters, and before I knew it I sailed right out to sea. But I was still in the unrelenting grasp of that chlorophyllic molecule.

"A little eel was searching for its breakfast in the sea of the Skaggerack when he spied my prison blade, and before you could count one, two, three I was down deep in his funny gullet. The funniest hotch-potch you ever saw was in that queer stomach—the

leg of a daddy-long-legs, a sea-urchin's chin, a piece of raw shad roe, and my blade of grass. Among us we soon learned that freedom was still far off, but all of us nitrogen atoms never talked or thought of anything else.

"The amenities of assimilation had it that my chlorophyllic molecule was reorganized and I next found myself more or less permanently lodged in the pancreas of the eel, with some other nitrogen prisoners, occupying a little island called the Langerhans all to ourselves, where we led a sort of a sweet existence. All of a sudden that erratic eel took an instinctive notion to travel and so, without even kissing good-bye to its mother, it slipped its way through the narrow fjord and headed for the high seas. Soon I found that there was method in its madness, for it developed that the eel was off to school. And what a school I found it to be. Millions of slimy little wrigglers capered about, apparently without design, yet headed for some fixed objective. How like, thought I, those schools in the land of the two-legged race.

"Ultimately, and I still was on the island in the pancreas of the eel, we came to that objective. It was the western coast of Chile. Norroway had been Chile enough for me, but I naturally went where the eel went. What I cannot understand, however, is the ridiculous notion that sent that silly eel all the way from Norway to this South American shore just to serve as a breakfast for the first fool seabird that happened along.

"We came upon Chile late one spring evening and our host the eel, instead of resting comfortably in a bed of warm alluvial mud, insisted on climbing to the surface of the sea just to get a little air before retiring. The first thing we molecules knew a great winged monster bumped against the ocean, grasped our eel in its claws, transferred it to a great yellow trunk, painted like an American Store, and from there slid it into its stomach. I was now on the inside of a bird called the pelican, so named, I am told, because it fits into a certain 'Wiley' nursery rhyme.

"Again I knew I would change my prison, although I had as yet no hope of freedom. The silly bird's alimentary processes, for some peculiar reason, did not choose this time to use my molecule for tissue building, and I was soon discarded as a worthless excrement.

"Piled high on this dreary island, where the Sun was always hot and raindrops never came, I suffered long imprisonment. I

knew my bonds were not so tight as in the sea plant prison, or in the eel's pancreas, but yet my hopes grew less and less until a Yankee sail ship came along one day and carried our humiliated molecules into the vessel's hold. There I heard I was part of guano and that instead of being bonded to carbon and hydrogen and such, my captors now were sodium the kind, and the everlasting oxygen, that hated son of a laborer.

"The Yankee ship carried me far from the sullen shores of the South to a place called Philadelphia, where this guano was greatly appreciated, for I conceitedly remember them saying 'it has a lot of nitrogen in it, and it is fine to speed the growth of plants.'

"Next I remember being wrapped in a paper bag and a two-legged being called man carried me to his home in the suburbs. Of course, then, I could not understand why that silly idiot took me all the way from the big city to a place called Smithtown just to sprinkle me on the ground in his back yard. Now, of course, I know why he did it. Along with me in the earth he carefully put a number of little round black grains, and after he had buried every one of them in a little hole in the ground he gently patted the earth over them, sprinkled them with my guano, passed unkind words about the odor of my person, and went back to the house perfectly well satisfied with himself.

"The first thing I knew, the same irresistible urge that I sensed off the coast of Norroway, when I first saw the sea grass, came over me again, and I was drawn to that little black grain which by this time had opened and had stretched out a lean long arm. Here again I thought I caught a glimpse of freedom. I divined the plan of the two-legged man and I knew that the little black seed would grow to a plant—and that is just what happened. It was but a little while that I found myself, yet sorrowfully so, part of a complicated molecule, in the cell of a nice red radish.

"Shortly, on a Sunday morning, the man came into his garden, roughly pulled from its earthy moorings my radish prison, and carried it and a few others proudly to his kitchen door. There he offered his collection to a busy person who was getting dinner ready.

" 'John,' said this pretty busy person, 'I hardly think it wise to eat radishes with oysters and bananas and ice cream and ginger ale and buttermilk and cottage cheese, as we have for dinner today, they might kill you.' I heard every word of it.

"But John, as Johns generally do, disregarded the sweet person's advice, and, enclosed in the root cell of a red, red radish, I took another trip to a stomach.

"Talk about the hotch-potch in the eel's stomach—and the pelican's bill of fare—John's stomach had them all beat for variety, for it was not only a delicatessen shop, but it had the wares of the drug store man and the hardware merchant as well.

"The next part of my story is sad—but it is short. Listen—John died, the next day, of too many radishes, or too much ice cream. Anyway, he died of acute indigestion.

"But oh! the gloriousness of it all—John was a Garibaldi though he did not know it, for in his will was written the declaration of my independence. He wanted to be cremated, and like all his living desires so was his desire in death gratified by that pretty person whom he left behind. Out to Stenton Avenue in Philadelphia the remains of John were carried. There they put him in an oven and turned on the gas.

"My happiness was unbounded. I knew that the heat of combustion would melt away my bonds. I feared not the warmth of the vessel in which they destructively distilled poor John—for I knew it would give me my freedom. The shackles were finally broken—and out of the chimney I scooted—and I never stopped until I reached once more the freedom of my father's land.

"Here, odd to relate, I found my brother atom, who had returned before me and whose wanderings in what he called the "Cycle" had been quite as strange as mine. Only the great difference was that he had broken his bondage in quite another way. For a chemist had linked him with glycerin in a very strong combination, and when a shell in which he was stored exploded in France, one morning, the shock was so great that his captive chains were shattered and he flew back to the air again. Never again will my brother and I visit the land of the Flash for we relish our freedom once more."

But still we have not proceeded far with the story of Nitrogen, particularly with the important part which it has occupied in shaping the destinies of the world in recent years.

Nitrogen started upon its most bloodthirsty course when someone in Europe learned that nitre had explosive possibilities when mixed with soot and sulphur.

It is said that China knew this secret when Europe was still in knee pants, but the simple-minded Chinese never thought of using it in warfare—they saluted their gods with it—it made a noise which even a wooden Buddha might hear.

But the Europeans bridled it in a different way. They packed it in guns and covered it with pieces of lead. When the power exploded the lead was propelled at a fearful pace and only stopped when it struck something solid or spent its force in air. Occasionally it performed its mission and found lodgment in the body of a human being.

The English first used it at Cressy, and scared the French so badly that they actually licked them. Then along came a Frenchman who with the usual Gallic sense of refinement invented a powder that was smokeless and ashless—much more satisfactory than the dirty old gunpowder. This powder was made by combining glycerin and nitric acid, a compound of nitrogen.

And all of these improvements that came along contained Nitrogen in its new man-killing role. After smokeless powder came the

high explosives such as gun cotton, a compound of cotton and nitric acid; then cordite from guncotton and nitroglycerin. The inventor of cordite was Nobel, of prize fame. Oddly enough, during the great World War, while Nobel's cordite was blowing humanity to Einsteinian fractions, the commission was awarding the prize given by his estate to "men prominent in the promotion of peace." Then came more nitrogenous death-dealers as lyddite and melenite and TNT.

And so we see that the demands of peace as well as the demands of war were high for Nitrogen. Indeed, between burning his stores of coal and wood—all of which contain fixed nitrogen, by burning instead of burying his brothers, by shooting it out in guns, by turning his sewage to sea, man for years had wasted his capital of fixed nitrogen.

Then along came the terrible World War where more fixed nitrogen was wasted by a day's firing of a Black Maria or a Jack Johnson from Krupps than could be stored up by a million dysenteric pelicans. Germany before the war had accumulated vast stores of nitrates. Her preparedness along this single line had long convinced chemists of her perennial itch for war. Huge stores of Chilean guano and saltpeter had been imported. In 1913 alone she purchased nearly a million tons.

So when war did come Germany was well supplied with explosive compounds. Yet when the English fleet off the Falkland Islands sent the German ships to the bottom of the sea and then bottled her warships at Kiel, it closed at once to Germany the nitrate beds of Chile. But even this did not deter the fighting German, and with an invention that came from America, he found another nitrate bed far paramount to Chile's.

With the pounding guns of the Aisne and the Marne blowing his nitrates back to the sky, and deprived of imported supply, the German scientist did what the world had failed to do in all its previous history. He reached to the sky for his nitrogen. Banished from the seas and hemmed in by land, he had only the sky left to him, and necessity once more brought invention.

Bradley, the American chemist, was the first to steal nitrogen from air and fix it in the form of useful compounds, just as the germ does or the thunderstorm. But he was not given much encouragement. Then two Norwegian chemists, Berkeland and Eyde, aided by the bountiful water supply of that land, took up the prob-

lem and produced nitrogen compounds so cheaply that it was sold on the Pacific Coast at a price lower than the Chile saltpeter.

Then the war came and the German chemists took hold of this problem. How well they accomplished it under the stress of war is answered by the statement that had they not been successful the war would have terminated long before it did.

At the conclusion of the war Germany was meeting the greater part of her nitrogen requirements by air nitrogen fixation. If her morale and man-power had answered the test of time as well as her chemists did, the war, unhappily, might still be going on.

Today there need be no further anxiety concerning the world's supply of nitrogen compounds, for in many countries there are great factories producing fertilizing and other nitrogen compounds in vast quantities, and so cheaply that their product can compete successfully with what fixed nitrogen Nature chooses to accumulate in her several savings banks.

These methods of nitrogen fixation are distinctly chemical or at least physico-chemical processes, although in practically every case they are patterned after Nature's own methods. Careful description of them at this time is out of the question, and yet, in conclusion, a brief review of the principal methods will not be amiss.

The three processes now in operation on a paying scale are referred to as the arc, the cyanamide and the direct synthetic ammonia process. There is another method now in operation in this country on a more modest scale, whereby the air nitrogen is fixed as sodium cyanide and hydrocyanic acid—that powerfully toxic compound of nitrogen, so toxic that a student is alleged to have described it as being "so very poisonous that one drop of it placed on the tongue of a dog would kill a man."

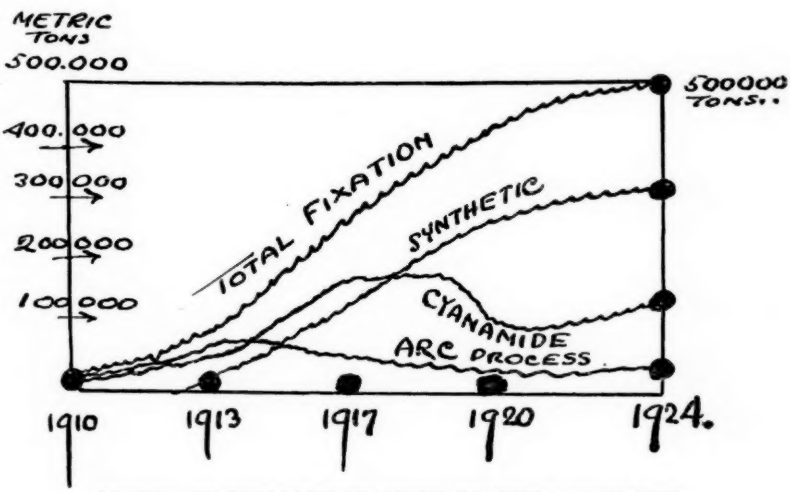
The arc method is patterned after Nature's lightning method of fixation. For every metric ton of nitrogen fixed by this method 68,000 kilowatt hours is the power requirement. Thus its successful operation demands cheap power. Hence its use in Norway, where there is a vast amount of potential water power.

The cyanamide process, whereby nitrogen is fixed by combination with finely powdered calcium carbide at comparatively high temperature, produces a compound rich in nitrogen, and one that is available with much less power than is used in the arc process.

Muscle Shoals, which Henry Ford coveted but failed to get, had a cyanamide plant with an annual output of 200,000 tons of that

compound—the largest plant of its kind in the world. The world's present output of cyanamide is down to 140,000 metric tons annually.

Lastly we come to the direct synthetic process, which is now accepted as the most successful of all the processes. This consists in forming ammonia directly from the nitrogen of the air and hydrogen secured elsewhere. This is known as the Haber process, and union of the elements is accomplished by a process of catalysis, using uranium or platinum or iron dust or other metal as the catalyst. The agent that performs the catalytic union behaves very like a parson. Indeed, a catalyst has been termed a "chemical parson." When a young couple finally decide that two can live as cheaply as one (although, as the wise ones know, that is a proven mistake, for the



OUTPUT OF NITROGEN FIXATION METHODS COMPARED.

only two that can live as cheaply as one are a dog and a bug on his back. The bug pays nothing for his food or his transportation) so when the young couple decide to go it together, they call on the marrying parson. Then a brief ceremony consisting of compromising "yeses," the parson whispers the ominous benediction, and the union is accomplished. But the parson henceforth enters not into the life of the wedded parties. He simply effected the union and the ingredients of the union soon go home and forget him.

So it is with a chemical catalyst. It performs the union of chemicals without itself being involved in the bargain, except as the

agent of the reaction. And so in the Haber synthetic process air is liquefied by pressure and cold—then the nitrogen is boiled off at 194 degrees C., leaving the oxygen behind for other useful purposes.

Hydrogen, the other party to the marriage, is produced from water, which is almost as cheap as air. The water is passed over red-hot coke and the hydrogen is glad to lose the company of its erstwhile coworker oxygen. Then the nitrogen and hydrogen, mixed in the proportion of 3 to 1, are strongly pressed again and heated to about 700 degrees C., and passed over the finely divided uranium, the catalyst. By this means is obtained a large yield of ammonia.

Then, if it is desired to change the ammonia, which is volatile, to a fixed compound, this is done, again with a catalyst, by changing it by the so-called Ostwald process into nitric acid. The ammonia gas and air (containing oxygen) are heated together and run over heated platinum gauze which plays the part of the parson according to the following scheme:

$$\underset{NH_3}{\text{Ammonia}} + \underset{2O_2}{\text{Oxygen}} = \underset{HNO_3}{\text{Nitric acid}} + \underset{H_2O}{\text{Water}}$$

Using the direct synthetic process, the Germans alone during the war had an annual nitrogen compound output that was in excess of the normal amount produced in Chile, namely, half a million tons.

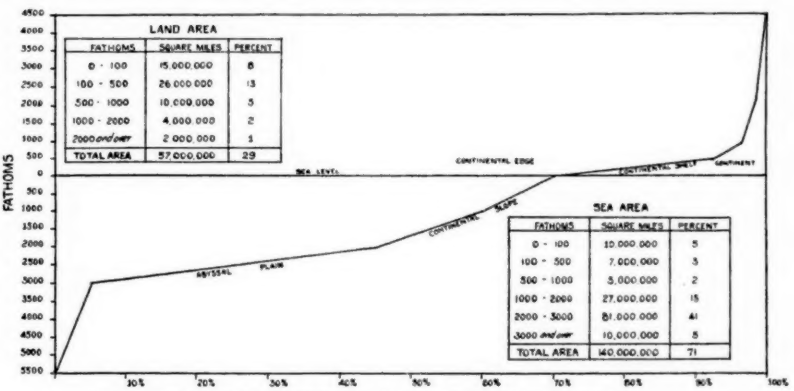
But my story has been already too protracted and probably too indefinite. Yet the subject is one where "going around in circles" is quite excusable. And so I bring it to a close. Much has been left unsaid because of unkind time and my kind regard for my audience's comfort. Some day, perhaps, another opportunity may come when I can again return to the subject and tell the rest of the story in a more complete and more entrancing fashion.

THE MINERAL AND VEGETABLE RESOURCES OF THE SEA.*

Ralph R. Foran, P. D.

To the landlubber, thoughts of the sea come only at vacation time, or when taking an ocean voyage. We know that the sea is salt, and that certain sea foods are very tasty. But there is much more of interest to be known.

The sea is so vast that it is difficult to appreciate its extent and volume. It covers nearly three-fourths of the earth's surface, about 139,000,000 square miles and is approximately 302,000,000 cubic miles in volume. The diagram will give some idea of the relative land



DIAGRAMMATIC SECTION SHOWING THE AVERAGE CONTOUR OF THE EARTH.
BASED UPON THE PERCENTAGES OF THE AREAS BETWEEN THE CONTOUR LINES ABOVE AND BELOW SEA LEVEL

and sea areas and also of the various depths of the ocean as compared with the elevations on land. It has been calculated that the mean average depth of the ocean is 12,060 feet, while the mean elevation of the surface of the continents above sea-level only 2300 fet. Nevertheless, the greatest depths of the ocean below sea-level and the greatest heights of the land above it are about the same, the summit of Mt. Everest rising to 29,000 feet above sea-level, while the Mindanao Deep, recently sounded near the Philippine Islands, sinks to 33,000 feet below sea-level. In general, the contour of the ocean bed resembles that of the land, with formations corresponding to our hills and valleys, plains, slopes and plateaus.

*One of a series of Popular Lectures given at the Philadelphia College of Pharmacy and Science, 1924-1925 season.

The deposits of the ocean floor may be classified into (1) deep sea deposits (beyond 100 fathoms), (2) shallow water deposits (less than 100 fathoms), and (3) littoral deposits (between high and low water marks). The deep sea deposits are those formed in deep water remote from land, and, depending on the depth, may be of the nature of clay, mud or ooze. The shallow water and littoral deposits are of sand, gravel and mud, and result from the continuous erosion of the coast by wave action.

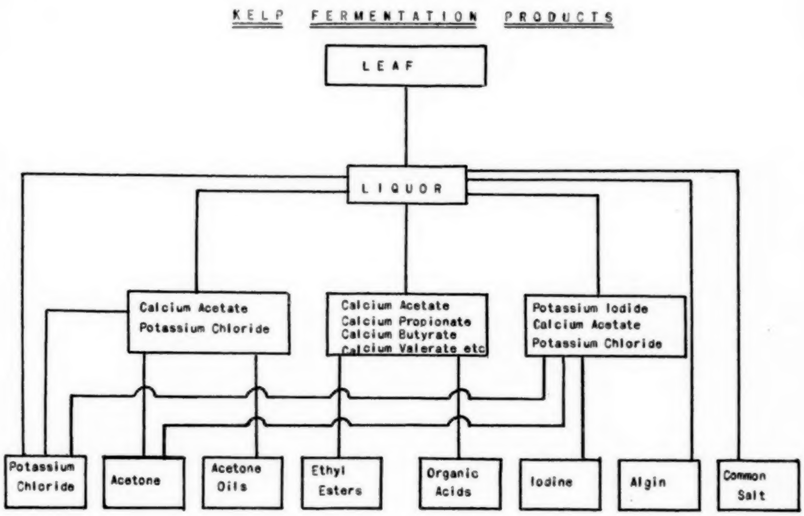
We say that the sea is salt, but the saltiness is not due to ordinary sodium chloride alone. If we evaporate sea water to dryness, the resulting solid will contain not only sodium chloride, but also magnesium, calcium and potassium in the form of chlorides and sulphates. There are present also appreciable amounts of bromine, iodine, iron, silicon, carbonate and phosphate. The figures given in the following table may be said to approximate the average composition of sea water and sea salt.

	Per 1000 Parts of Water.	*Per Cent. of Total Salts.*
Sodium Chloride (Common Salt)	27.213	77.758
Magnesium Chloride	3.807	10.878
Magnesium Sulphate (Epsom Salt)	1.658	4.737
Calcium Sulphate (Gypsum)	1.260	3.600
Potassium Sulphate	0.863	2.465
Magnesium Bromide	0.076	0.217
Calcium Carbonate and Residue	0.123	0.345
	35.000	100.000

Thirty-three of the eighty known elements have been identified in sea water and included among these are gold, silver and radium. The amounts of these elements are very small, but this has not deterred some unscrupulous persons from trying to sell stock in companies organized to extract "gold from sea water." It has been estimated that a cubic mile of sea water contains gold to the value of $93,000,000, but the cost of recovering this gold is hundreds of times greater than the value of the gold obtained.

Although we look upon ordinary salt as common and cheap, it is a very necessary commodity. Not only do we need it in seasoning and preserving food, but in the curing of hides, the making of brines for refrigeration and ice factories, in the making of dyes and for the

preparation of sodium and chlorine. Large quantities of salt are used in oil refining, the ceramic industries, in metallurgy, paper works and the textile industry. While it is true that most of the salt produced in this country is obtained from crude rock salt or from natural brines, the manufacture of salt from sea water by solar evaporation is still an important industry in many warm countries where the rainfall is light. In California more than 97 per cent. of the salt produced, is made from sea water, evaporated by the heat of the sun, and in Italy, Portugal, France, China, Japan, India, Brazil and many of the islands of the West Indies, the solar sea salt industry is of importance.



In the refining of sea salt, many by-products may be recovered. Included among these are magnesium sulphate, magnesium chloride, potassium chloride, bath salts, low-grade salts, magnesium oxychloride cements and artificial stone. Metallic magnesium and bromine have also been prepared on an experimental scale.

The salt that we use as a condiment is very pure sodium chloride, but of late there has been some suggestion toward the use of unrefined sea salt. As this contains, other than sodium chloride, traces of the thirty-odd elements said to be present in sea water, it will furnish a salt containing all of the elements necessary to proper growth and health. It will contain iodine for the thyroid

gland and fluorine for the bones and teeth. Goiter, caused by iodine deficiency, will be prevented by the use of a salt containing the required iodine. As a matter of fact, there has recently appeared on the market an "iodized salt," containing one part of potassium iodide to 5000 parts of the salt. The next logical step will be the marketing of unrefined sea salt for use in place of the highly refined table salt now available. To overcome the tendency of sea salt to take up moisture and cake, a recent investigator has found that if six grams of phosphoric acid per liter is added to sea water, and the mixture evaporated to complete dryness, the resulting mass will be non-hygroscopic and of pleasant taste. It will contain all of the mineral salts required by the human body. Its general acceptance and use will be another step in the "back-to-nature" movement in foods, which has received so much publicity of late in connection with the study of vitamines.

The sea is teeming with animal and vegetable life. The largest animals and the largest plants are found in the ocean. It has been estimated that the vegetable matter of the seas is equal in amount to the plant growth of the land, and very little of this is utilized at all. Some seaweed is used as fertilizer along the coast in the British Isles, Europe, Japan and elsewhere and about one-third of the world's supply of iodine is obtained by burning seaweed or kelp. In some places where forage crops are scarce and dear, seaweeds are occasionally fed to stock. In countries such as Japan and Hawaii, where vegetables are relatively high in price, seaweeds form a regular part of the diet of certain classes of the people.

Many suggestions have been made for the more varied and extensive use of seaweeds or marine algæ. Over five thousand species have been noted, ranging in size from microscopic to very large. They are simple plants and ordinarily grow either under or partly under water, and either attached to the bottom or floating. There is no true differentiation into root, stem and leaf and they reproduce by spores. Being chlorophyllous plants they are able to synthesize carbohydrates from carbon dioxide and water, by means of the energy received from the sun's rays.

As stated before, some of our iodine is obtained from the ashes of seaweeds. But these ashes were utilized long before iodine was discovered, being used as a source of alkali needed in the manufacture of glass, soap and alum. The composition of the ash varies for different species, but contains principally potassium and sodium car-

bonates, chlorides, iodides and sulphates of potassium and sodium, calcium carbonate and siliceous matter.

In the United States, seaweeds were not utilized until about 1900, when the high potash content of the Pacific coast seaweeds or giant kelp was recognized. Kelp beds extend all along our Pacific coast, from San Diego to Alaska, insuring ample supplies of raw material. The outbreak of the World War and the scarcity of potash, gave impetus to the exploitation of these kelp beds as a source of potash, and in 1917 the United States Department of Agriculture, by authority of Congress, erected an experimental kelp potash plant at Summerland, California.

In the process used at this experimental plant, the chopped kelp is first dried, and then distilled in a specially designed retort. The volatile products are drawn off at the top of the retorts and the kelp fed in at the top gradually works downward as it shrinks in volume. After passing the hottest part of the retort, the char is discharged into a small hopper, constituting the bottom of the retort, where it partially cools. At regular intervals this is removed, cooled and ground.

The volatile products are condensed, yielding an oily liquid and an ammonia liquor. In addition, some gas is returned and burned under the retorts. The oils and ammonia obtained are valuable by-products.

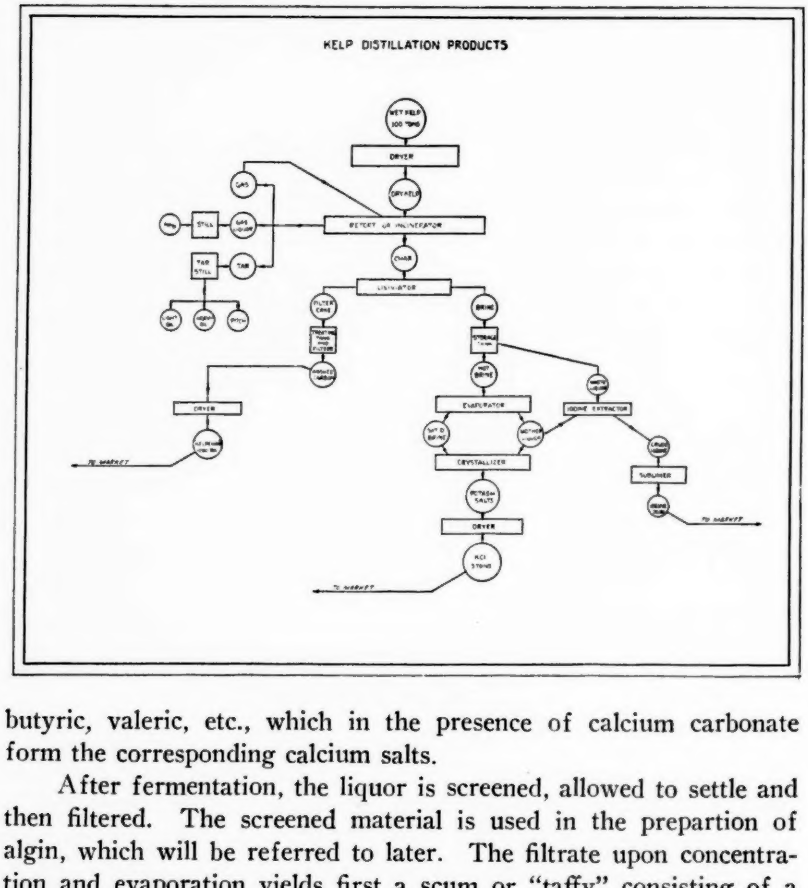
Potash is extracted from the charred kelp by a leaching process, leaving behind a charcoal known as "kelpchar," which has excellent decolorizing properties. The mother-liquor obtained in the crystallization of the potash, is worked for iodine.

Reference to the chart will show the detailed operations and end products of this destructive distillation process.

During the war this kelp potash industry was second in importance in the United States. At the end of the war and upon the resumption of shipments of foreign potash the plant was dismantled, as competition with the cheaper supply from abroad could not be met.

Another interesting utilization is illustrated in the Hercules Powder Company's method for producing acetone by the fermentation of kelp. Large quantities of acetone are required in the manufacture of smokeless powder and, during the war, it became necessary to devise a new method for making it.

In this process the chopped and macerated kelp is placed in large wooden tanks, diluted with water, and allowed to ferment. Each tank is equipped with hot water coils to regulate the temperature and with compressed air pipes for agitation. The proper acidity of the fermenting "mash" is maintained by adding calcium carbonate from time to time. In the fermentation, which requires about two weeks, various organic acids are formed, such as acetic, propionic,



butyric, valeric, etc., which in the presence of calcium carbonate form the corresponding calcium salts.

After fermentation, the liquor is screened, allowed to settle and then filtered. The screened material is used in the prepartion of algin, which will be referred to later. The filtrate upon concentration and evaporation yields first a scum or "taffy" consisting of a mixture of calcium acetate, propionate and valerate and is used in the making of solvent esters, by mixing with ethyl alcohol and sulphuric acid, the esters formed being separated by fractionation.

Upon further concentration, crude calcium acetate, containing some potassium chloride, separates. This mixture upon heating in

retorts yields acetone and other mixed ketones, the residue of calcium carbonate and potassium chloride in the retort being leached for the potash.

The final product of the concentration is potassium chloride, 95 to 98 per cent. pure. Iodine also is recovered. The chart shows the ultimate products obtained in this fermentation process.

This plant, also, was dismantled immediately following the war, as the process was evidently not profitable under peace time conditions. Although designed and operated primarily for the manufacture of acetone, the by-products were all valuable and useful.

It is believed that it is possible to produce potash from kelp at a profit, provided all of the by-products are utilized and provided that the kelp can be harvested cheaply enough.

In this country, very little seaweed is eaten, although Irish moss and dulse are used in some sections, by certain classes of people. In Japan and Hawaii, however, seaweeds are of such importance as to necessitate their artificial cultivation. The Japanese children are early taught to eat seaweed foods and are told that they are "brain foods," much as the young children in this country are taught to eat the crust of bread "to make the hair curly." The use of seaweeds, containing natural sea salt, in the diet of the young Japanese may account for the wonderful teeth for which the Japanese are noted.

Chief among the seaweed foods eaten by the Japanese are *amanori* and *kombu*. *Amanori* is prepared by baking the particular seaweed over a fire until it is crisp. This is then eaten with soups or broths, or made into *sushi,* which corresponds to our sandwich. Boiled rice is piled upon a sheet of the baked *amanori,* and then strips of meat or fish are placed on the rice. The whole of this is rolled up and cut into transverse slices.

Kombu is prepared for eating in a variety of ways. Most important is shredded green dyed *kombu,* prepared by dyeing the dried kelp in a large kettle containing a solution of malachite green. After dyeing, the kelp is partially dried, then flattened out, arranged in piles, compressed and then shredded with a plane. The finished product resembles in color, shape and feel, the Spanish moss which hangs from the trees in our southern states. It is one of the standard foods of Japan and is cooked with meats and soups and also used as a vegetable.

Agar-agar is also a favorite seaweed food of the Japanese and Chinese, being eaten in the form of jellies and as a thickener for

soups, sauces and gravies. In the preparation of agar-agar, the selected seaweed is cleaned, bleached and then boiled with water until practically all of the seaweed has gone into solution. The solution is then strained and the strained extract allowed to cool, when it solidifies into a firm jelly. The jelly is cut into strips and frozen. This causes the water to crystallize out, so that when later thawed, most of the water runs out, taking with it the substances which are soluble in cold water. The agar-agar is then dried, cut into uniform lengths and packed in bundles.

In the United States, the manufacture of agar has been one of the few novel industries that have been introduced since the World War. The process used is essentially the same as the Japanese process.

Agar is a substance having many valuable properties. The chief constituent is a carbohydrate, pectin-like substance called d-galactan or gelose. It swells rapidly in cold or lukewarm water and if boiled until solution is affected, it will form a stiff gel when cooled to room temperature. Even a one-half per cent. solution will give a firm jelly.

In this country, agar is used chiefly in medicine and in bacteriological work, but as it becomes better known and cheaper, it is sure to find increasing use in the culinary arts.

Algin, or alginic acid, previously referred to as a by-product in the fermentation process for kelp, occurs in large quantities in many seaweeds. From this algin can be made salts known as alginates, of which sodium alginate is the most useful. It may be used as a sizing material, for fixing mordants and for many other purposes. Materials which have been treated with sodium alginate may be made waterproof by treatment with weak hydrochloric acid and washing. Recently, a series of products known as "Alkagels" have been put on the market for use in alkali- and water-proofing cements and stucco, as binding material, for insulating purposes and so forth. The basic ingredient in these compounds is presumed to be ammoniated aluminum alginate, which has the property of becoming insoluble after drying.

Among the odd uses for seaweeds may be mentioned the manufacture of paper, cloth, ornaments and curios, and even in Kamschatka for the preparation of an alcoholic drink. The word "hooch" is derived from "hoochena," the name of a distilled liquor made by

the Eskimos. In this distillation that Eskimo makes use of the long hollow stems of certain kelps, coiled in the form of a condenser.

The intensive cultivation of the more valuable seaweeds is not entirely impossible, and as the ocean is transparent to a depth of nearly a thousand feet under normal conditions, the sunlight can penetrate and supply energy to vegetation at a considerable depth and over a great area. When this time comes we will then have what might be called "marine farming," or "cubical cultivation," as Dr. Slosson calls it. Thus, the unwary purchaser of a submerged ocean front lot may, after all, turn his loss into a profit, by planting and harvesting large crops of succulent seaweeds or high potash kelp.

THE DRUGS OF THE NORTH AMERICAN INDIAN (II).

Heber W. Youngken, Boston, Mass.

(*Concluded from the March Issue.*)

Parnassia fimbriata Konig. (Rocky Mountain Parnassia.) The Cheyenne made a tea of the powdered leaves and gave this to infants for disordered stomach.

Parosela aurea (Nutt.) Britton. (*Dalea aurea* Nutt.) The leaves were used in a decoction by Western tribes for colic and dysentery.

Pedicularis grœnlandica Retz. (Lousewort.) A decoction of the leaves and stems was drunk by the Cheyenne for cough.

Pentstemon grandiflorus Nutt. (Wild Fox Glove.) The Indians of the Missouri River region used the leaves in decoction as a remedy for chills and fever.

Pentstemon Torreyi Benth. (Beard Tongue.) The Tewa, at Santa Clara, employ this plant as a dressing for sores.

Perezia arizonia A. Gray. A soft silky substance found on the branches of this plant was used by the Apache to check hemorrhages from various wounds.

Perezia Wrightii A. Gray. The Apache drank a decoction of the root for pain in the stomach. The soft, cottony part of the root was applied to sores and wounds and placed around the umbilical cord in the newborn.

Peritoma serrulatum (Pursh) DC. (Rocky Mountain Bee Plant.) The Tewa mixed the ground plant with water and drank

the liquid as a remedy for stomach disorders. They also wrapped fresh plants in cloth and applied this packing to the abdomen.

Petasites palmatus (Ait.) Gray. (Sweet Coltsfoot.) The Menomini used a decoction of the white roots of this composite for the itch.

Petalostemum candidum (Willd.) Michx. (White Prairie Clover) and *P. purpureum* (Vent.) Rydb. (Purple Prairie Clover.) The roots of these species were used as a favorite prophylactic by the old Pawnee tribe. For this purpose they were powdered and placed in hot water. When the sediment settled, the water was drunk to keep away disease. Later the sediment was collected in a drinking vessel and interred with respect.

Phlox multiflora A. Nels. (Phlox.) The leaves and flowers were powdered and made into an infusion by the Cheyenne who rubbed it over the patient and administered it as a tea for numbness.

Phoradendron juniperinum Engelm. (Mistletoe.) The Tewa drank a mixture of the ground plant in hot water for chills in the stomach.

Phryma leptostachya L. (Lopseed.) The roots were boiled and the decoction taken for rheumatic pains in the legs by the Ojibwa.

Phyllanthus sp. The Mescaleros made a decoction of the broken leaves and twigs which was applied externally and drunk for itching.

Physalis lanceolata Michx. (Prairie Ground Cherry.) The root was used by the Plains tribes in the smoke treatment. These Indians also made a decoction of this root which they used for headache and stomach trouble and employed the powdered root as a dressing for wounds.

Physalis viscosa L. (Large Bladder Ground Cherry.) The Buffalo doctors of the Omaha tribe used the root in dressing wounds.

Physocarpus opulifolius (L.) Maxim. (Ninebark.) The bark of this rosaceous shrub was used by the Menomini in a drink for female disorders.

Picea canadensis (Mill.) B. S. P. (White Spruce.) A tea was made from the inner bark and used by the tribes of the Northwest for various internal diseases. The inner bark was partly cooked and beaten by the Menomini in the preparation of a poultice for wounds, cuts or swellings.

Picea mariana (Mill.) B. S. P. (Black Spruce.) The leaves and crushed bark were made into a decoction and used by the Ojibwa for headache.

Pinus edulis Engelm. (Pinon.) The needles were chewed by the Zuni for syphilis. This tribe also used the gum (oleoresin), which they powdered and sprinkled into an incision as an antiseptic, after first cleansing the wound with decoction of red willow bark.

Pinus brachyptera Engelm. (Rock Pine.) The oleoresin was used by the Tewa for excluding air from cuts and sores.

Pinus resinosa Ait. (Red Pine.) The leaves of this tree and the next,

Pinus strobus L. are crushed or boiled by the Ojibwa and applied to relieve headache. They are also put into a small hole in the ground and hot stones placed thereon; the vapor which rises is inhaled to cure backache and headache. The inner bark of young trees only was employed by the Menomini. This they steeped in water and drank the liquid for chest pains. They also pounded the bark and used it as a poultice for wounds, sores and ulcers.

Piptadenia peregrina Benth. (Cohoba.) The aborigines of Hayti made a narcotic snuff from this tree which they took by means of a bifurcated tube.

Plantago major L. (Plantain.) The Ponca tribe heated a bunch of fresh Plantain leaves and applied these to the foot to draw out a thorn or splinter. The Menomini also heated the leaves of this species and applied them to swellings.

Polygonum lapathifolium L. (Smartweed.) The Zuni doctors gave a decoction of the root as an emetic and purgative.

Polygonum pennsylvanicum L. (Pennsylvania Persicaria.) The leaves were dried and made into a tea by the Menomini as a remedy for internal hemorrhage.

Polyporus officinalis Fries. (White Agaric.) The fruiting body of this fungus yields a reddish coloring matter which was formerly used by the Indians to paint their faces.

Populus candicans Ait. (Balm of Gilead.) The leaf-buds are cooked with animal fats by the Menomini in the preparation of a salve which is placed in the nostrils for coryza and applied as a dressing for wounds.

Populus molinifera Ait. (Northern Cottonwood.) The cotton-down was applied to open sores as an absorbent by the Ojibwa.

Populus Sargentii Dode. (Sargent's Cottonwood.) The waxy buds of this tree were boiled in the early spring by the Plains tribes to make a yellow dye. Another yellow dye was made by boiling the fruit of this plant. Feathers for pluming arrows were dipped into this decoction and stained yellow.

Populus tremuloides Michx. (Aspen.) The Cree Indians used the inner bark as a laxative and cough remedy. The Tewa drank a decoction of the leaves for urinary trouble.

Potentilla fruticosa L. (Shrubby Cinquefoil.) This plant was known to the Cheyenne as "Contrary Medicine." During the Contrary dance the powdered dried leaves or an infusion of the powdered leaves was rubbed over the hands to protect them from injury when they are thrust into a kettle of boiling soup. The infusion was rubbed over the entire body to protect it from severe temporary heat.

Polystichum acrostichoides (Michx.) Schott. (Christmas Fern.) The Cherokee used a decoction of the root of this fern internally to induce vomiting. They rubbed it on the skin, after scratching, for rheumatism, and held a warm decoction in the mouth to relieve toothache.

Prosopis pubescens Benth. (Screw Mesquite.) The inner bark was made into a decoction by the Papago and drunk for chronic indigestion. The Pima used the sap for sore eyes and the boiled sap for sores on the heads and faces of little children. They also employed the juice and bark over which it flowed as a remedy for sore throat. The Tewa twisted the pods of this plant into the ears of patients as a cure for earache.

Prunus Americana Marsh. (Wild Plum.) The Cheyenne used the small rootlets and bark of older ones. These they crushed and boiled with the roots of the Scarlet Thorn (*Cratægus coccinea*) and other roots in preparing a diarrhœa remedy. A decoction of the inner bark of the root was applied by the Omaha to skin abrasions.

Prunus Pennsylvanica L. (Wild Red Cherry.) A decoction of the crushed root was drunk for various stomach disorders by several of the tribes.

Prunus Virginiana L. (Choke Cherry.) The branches of this tree were used in preparing a drink given in gestation. Decoctions of the inner bark or berries were used by several tribes for diarrhœa.

Psoralea argophylla Pursh. (Curf Pea.) The Cheyenne used

the leaves and stems in decoction as a fever remedy. They made an ointment by incorporating the powdered leaves and stems with grease and rubbed this over the patient's body to cure a high fever.

Psoralea tenuiflora Pursh. The Zuni moistened the leaves of this herb with water and applied them to the armpits, feet and other parts of the body for purification.

Psilostrophe tagetina (Nutt.) Greene. The Zuni made a yellow dye from the blossoms of this plant.

Pterospora andromeda Nutt. (Pine Drops.) This herb, parasitic on the roots of pines, was employed by the Cheyenne tribe to prevent bleeding from the lungs or nose. The stems and fruits were ground together and then boiled in water. Upon cooling, some of this decoction was snuffed up the nose and placed on the head for nosebleed and drunk for hemorrhage of the lungs.

Ptelea trifoliata L. (Wafer Ash.) The bark of the root is employed by Western tribes for various ailments.

Pteris aquillina L. (Brake). A decoction of the rhizome and roots of this fern is used by the Menomini tribe as a galactagogue.

Ptiloria tenuifolia (Torr.) Raf. All of the Zuni fraternities used this plant as a cure for rattlesnake bite. The entire plant was powdered between stones and dusted on the wound on four successive mornings. The wound was sucked as quickly as possible after the accident and before the application of the powder. Some of this powdered drug was also placed in water which the patient drank when thirsty.

Quamoclidion multiflorum Torr. (Wild Four O'Clock.) The root of this herb was used as medicine by the Indians of the Southwestern States. The Tewa tribe ground it and prepared an infusion which was drunk for swelling in dropsy. The Zuni men gather the root and give it to the women of the family who powder it and administer the remedy. The woman giving the medicine takes some into her mouth, and, ejecting it into her hands rubs them over the abdomen of a patient with indigestion from overeating. It is said that the Zuni women frequently slip a pinch of the powdered root into water to be drunk at meal time by the young men of the family to prevent them overindulging their appetites.

Quercus velutina Lam. (Black Oak.) The bark was crushed and made into a decoction by the Menomini, the clear liquid of which was applied as a remedy for sore eyes.

Radicula sinuata (Nutt.) Greene. (Water Cress.) The Zuni used this plant in making an infusion for use as an eye-wash. They also powdered the blossoms and sprinkled this over hot coals placed in a bowl, over which the patient with inflamed eyes held his face. The fumes induced a copious flow of tears which was said to give quick relief.

Ratibida columaris (Sims) T. and G. (Yellow Cone Flower.) The Cheyenne tribe applied a decoction of the leaves and stems to wounds from rattlesnake bites and also to poison ivy eruptions. The Zuni drank the infusion of the entire plant as an emetic.

Rhus aromatica Ait. (White Sumac.) The Ojibwa boiled the roots with those of Big Heart Leaf and took the decoction as a diarrhœa remedy.

Rhus glaba L. (Smooth Sumac.) Many of the Indian tribes gathered the leaves of this shrub after they turned red and used them for smoking either with or without tobacco.

The Omaha and Winnebago made a yellow dye from the roots. The Pawnee used a decoction of the fruits as a remedy for dysmenorhœa and bloody flux and applied it as a styptic wash. They took a decoction of the root as a remedy for retention of the urine. They also made a poultice from bruised leaves and fruits which they applied wet for skin poisoning.

Rhus trilobata Nutt. (Lemonade Sumac.) The leaves of this plant were mixed either with tobacco or with the leaves of Uva Ursi and Red Willow (*Cornus stolonifera* Michx.) bark and used for smoking by the Cheyenne.

Rhus typhina L. (Staghorn Sumac.) Several parts of this tree were used by the Menomini Indians. The inner bark of the trunk was employed as an astringent in piles; the root bark was used in a tea for internal troubles, the hairy twigs for female disorders and the acid fruits for pulmonary diseases.

Ribes Americanum Mill. (Wild Black Currant.) A strong decoction of the root was drunk by the Omaha as a remedy for kidney trouble and by the women of the Winnebago for uterine trouble.

Rosa humilis Marsh. (Pasture Rose.) The skin of the hips was eaten by the Menomini as a stomachic.

Rosa pratinicola Greene. (Wild Rose.) Western tribes used the inner bark for smoking either *per se* or mixed with tobacco. The fruits were also used in the preparation of a wash for inflammation of the eyes.

Rosa sp. The petals of various roses were incorporated with grease by the Tewa to make an ointment for sore mouths.

Rubus allegheniensis Porter. (Allegheny Blackberry.) The Menomini used an infusion of the rhizome and roots as an eye wash and astringent lotion.

Rubus occidentalis L. (Black Raspberry) and *R. strigosus* Michx. (Wild Red Raspberry.) The Dakota, Omaha-Ponca, Pawnee, Penobscot, Ojibwa and probably other tribes employed the rhizomes and roots in decoction for stomach and bowel troubles. The Menomini used the root with that of Great St. John's Wort in treating the first stages of consumption.

Rudbeckia fulgida Ait. (Cone Flower.) The Cherokee employed a decoction of the root internally for genito-urinary diseases and as a wash for snake bites and swellings caused by worms. They also dropped it into weak or inflamed eyes.

Rumex hymenosepalus Torr. (Canaigre.) The root was employed by the Western tribes for several purposes. The Apache employed it in decoction for coughs and consumption, the Pima for sore lips and sore throat, the Wichita and Pawnee for diarrhœa. The Zuni theurgists gave their patients the powdered root for sore throat. The Maricoba and Pima boiled the juice of the plant and placed it in the eyes or on the eyelids for inflammation. The tribes of Arizona and Southern Utah obtained from the root a bright-brown or mahogany dye.

Rumex venosus Pursh (Dock). The Cheyenne tribe prepared dyes from this Dock. If a yellow dye was desired the roots were cut into small segments and boiled, and the yellow decoction used after cooling; if a red dye, ashes were put in the yellow decoction and it was again boiled; if a black dye was required, the bark of the red willow was scorched and powdered and put in the yellow or red dye and boiled.

Salix candida Willd. (Hoary Willow.) The Ojibwa scraped off the inner bark of the roots and prepared a decoction which they took for cough.

Salix sp. The California Indians used a decoction of Willow leaves for fever.

Salix humilis Marsh. (Dwarf Willow.) The roots are gathered by the Menomini only from those shrubs which bear galls and used as a remedy for colic, dysentery and diarrhœa.

Sambucus canadensis L. (American Elder.) A tea made from the dried flowers was drunk by members of a number of tribes as a diaphoretic.

Sambucus racemosa L. (Red-berried Elder.) The Menomini prepare a decoction from the main stem which is used only in extreme exigencies as a drastic purgative.

Sarracenia purpurea L. (Northern Pitcher Plant.) The rhizome was used by Canadian tribes in the treatment of smallpox, in the form of an infusion.

Saxifraga Jamesi Torr. (Saxifrage.) The Cheyenne tribe dried and powdered the plant and used it as a tea for hemorrhage of the lungs.

Scirpus lacustris L. (*Scirpus validus* Vahl.). (Great Bulrush.) The pollen of this rush, known as "hadntin," represents the sacred yellow pollen of the San Carlos Apache. The medicine-man of this tribe rubbed it on the affected parts of the patient. He then sang and pretended to extract the objective cause of the sickness by sucking over the most painful part. Sometimes he would place a little pollen in the patient's mouth.

Senecio aureus L. (Life Root.) The aborigines used this plant as a remedy for hemorrhages, bruises and abortion.

Senecio triangularis Hook. (Groundsel.) The Cheyenne tribe used a hot infusion of either the leaves or roots of this plant as a sedative and for pain in the chest.

Senecio multicapitatus Greene. The flower heads and roots were used as remedies by the Zuni. The flower heads were moistened with cold water and tied in a cloth through which the medicated water was dropped into the eyes as a remedy for inflammation. The root was ground fine, mixed with cold water and the resulting infusion rubbed over the limbs for "aching bones." The theurgist applied this medicine morning, noon and night, each time invoking the cougar of the North and the bear of the West, since this medicine was believed to be the special property of the Zooic gods.

Silphium laciniatum L. (Pilot Weed.) The Pawnee took a decoction of the pounded root for general debility. The same preparation was used by the Santee-Dakota as a vermifuge and by the Omaha-Ponca as a tonic for horses.

Silphium perfoliatum L. (Cup Plant.) The Plains tribes used the rhizome in the smoke treatment for neuralgia, rheumatism and

cold in the head. The Winnebago made a decoction of the rhizome which was taken as an emetic before starting out to hunt buffalo or undertaking any other important duty.

Sisyrinchium albidum Raf. (Blue-eyed Grass.) This member of the Iris family together with another allied species, the Prairie Blue-Eyed Grass (*S. campestre* Beckm.) were employed to ward off snakes. The Menomini fed the root mixed with oats to their ponies to make them spirited and vicious.

Smilacinia racemosa (L.) Desf. (False Solomon's Seal.) The rhizomes and roots were placed on red hot stones by the Ojibwa and the fumes inhaled by the patient suffering with headache or catarrh.

Smilax herbacea L. (Carrion Flower.) The fruits were eaten by Western tribes to relieve hoarseness.

Solanum elaeagnifolium Cav. (Bull Nettle.) The Zuni chewed the root of this plant and placed the mass in the cavity of a tooth for toothache.

Solanum rostratum Dunal. (Buffalo Bur.) The Zuni powdered the root and placed a pinch of the powdered drug in a small quantity of water which was drunk to relieve sick headache.

Solidago altissima L. (Tall Goldenrod.) The Zuni chewed the flower heads for sore throat and drank an infusion of these for symptoms resembling La Grippe.

Sophora secundiflora Lag. (Red Bean.) The scarlet, bean-shaped seeds of this leguminous tree were used by the tribes of Northern Mexico, Texas and Iowa in the preparation of a narcotic decoction or brew. This was drunk by them to induce exhilaration and vomiting in their cleansing ceremonies. In addition, the Iowa Indians wore the seeds on their belts as a charm to protect them from injury when they engaged in warfare.

Spathyema fœtida (L.) Raf. (Skunk Cabbage.) The Menomini dried and powdered the root and dusted it over the surface of wounds. They also tattooed a medicine prepared from the root into the skin of the patient over the seat of the pain as a talisman against its return.

Sphæralcea lobata Woot. (Globe Mallow.) The Tewa pounded the roots to a fine powder which they applied to wounds caused by snake bites and to sores which were opening. They also made a paint from the skin of the root which they smeared on their faces before attending a dance.

Sporobolus heterolepis Gray. (Little Flat Grass.) Western tribes used a decoction of the roots as an emetic.

Stanleya pinnata (Pursh.) Britton. The Zuni theurgist used this powdered cruciferous herb in treating syphilitic ulcers. The ulcers were scraped with the finger nail until blood appeared, when the parts were bathed with cold water and the powder applied either by sprinkling with the fingers or by ejecting it from the mouth on the ulcers.

Sticta glomulerifera (Light) L. (Tree Lichen.) This lichen is gathered from the hemlock and maple trees by the Menomini, placed in soups and eaten for its supposed tonic effects.

Symphoricarpos occidentalis Hook. (Buck Brush.) The Omaha-Ponca applied an infusion of the leaves to weak or inflamed eyes.

Symphoricarpos Symphoricarpos (L.) Mac. M. (Coral Berry.) Used as preceding species.

Symphoricarpos vulgaris Michx. (Indian Currant.) The inner bark of the root was made into a decoction by the Ojibwa and applied, when cold, to sore eyes.

Tænidia integerrima (L.) Drude. (Yellow Pimpernel.) The root was steeped in water and then chewed for bronchial affections by some of the Western tribes.

Tanacetum vulgare L. (Tansy.) An infusion of the leaves and flowering tops is drunk by the Cheyenne tribe for a feeling of weakness and dizziness.

Taxus canadensis Marsh. (American Yew.) Branches of this conifer together with the leaves of the hemlock and white cedar were used in the medicine lodges of the Menomini in the medicated steam bath as a remedy for rheumatism, paralysis and numbness.

Tephrosia Virginiana (L.) Pers. (Turkey Pea.) The Cherokee employed a decoction of this plant for lassitude. Their women washed their hair in a decoction of the roots to prevent its breaking or falling out, because these roots are very tough and hard to break.

Tetraneuris scaposa DC. (Greene.) The Zuni used an infusion of this entire plant externally for sore eyes and skin affections.

Thalesia fasciculata (Nutt.) Britton. (Cancer Root.) The powdered entire plant was considered a specific for piles by the Zuni.

Thalictrum sparsiflorum Turcz. This plant was dried and powdered by the Cheyenne and given to horses to make them spirited and long-winded.

Thermopsis rhombifolia (Nutt.) Richards. (False Lupine.) The Pawnee and other Western tribes mixed the dried flowers with hair which they burned under the painful areas, in cases of rheumatism. A close covering was placed around the patient's limb and the burning mixture to confine the smoke and heat.

Thuja occidentalis L. (Arbor Vitæ.) The aborigines of Northeastern North American made an ointment for rheumatism from the fresh leaves and bear fat. The Menomini make a tea from the inner bark for suppressed menses and use the leaves as a smudge to revive persons who faint. Various tribes have used the bark of this tree in the sweat treatment.

Trichostema lanatum Benth. (Romero.) A strong decoction of the leaves of this herb was used by the Indians of Mexico and Lower California to impart a dark or black color to hair.

Trillium grandiflorum (Michx.) Salisb. (Wake Robin.) The Menomini grated the rhizome and applied it as a poultice to reduce swelling of the eye. This tribe also used a tea made from the rhizome for cramps and irregular menstruation.

Triosteum perfoliatum L. (Feverwort.) The Cherokees used a decoction of this herb to cure fevers.

Tripterocalyx wootonii Standley. The powdered root was placed in warm water and drunk for swollen glands as well as to relieve effects of snake bites.

Triticum sativum L. (Wheat.) The Papago tribe applied a plaster of wheat flour over the temples as a headache remedy. They thought it acted by stopping the air from going through the temples.

Tsuga canadensis Marsh. (Hemlock.) The Menomini used an infusion of the inner bark for colds and abdominal pains. The leaves were used by several tribes in the smoke treatment.

Ulmus fulva Michx. (Slippery Elm.) In addition to the uses of the inner bark, as reported in my previous article, it was employed by the Menomini to draw pus out of wounds. They took a small sliver and forced it into the sore, then bound it up with a poultice to reduce the swelling.

Ustilago Maydis Leville. (Corn Smut.) This drug is used by the Zuni as a parturient and as a remedy for post partum hemor-

rhage. The Tewa, at San Ildefonso, stir it in cold water and drink the mixture as a remedy for irregular menstruation.

Uvularia grandiflora Sm. (Bellwort). This herb was used as a poultice by the Menomini to reduce swellings.

Vaccinium scoparium Lieberg. (Tiny Red Whortleberry.) The Cheyenne doctors powder the dry berries, leaves and stems and administer these to patients suffering from poor appetite. The powdered leaves and stems are also used for nausea.

Valeriana edulis Nutt. (Edible Valerian.) The rhizome and roots constitute a valuable tapeworm remedy of the Menomini. After the parasite is expelled, it is washed clean, dried, powdered and swallowed by the patient, in order that he may become fat and healthy. The ground drug was applied to cuts to stop pain and hemorrhage.

Valeriana uliginosa (T. & G.) Rydb. (Swamp Valerian.) The Menomini employ the rhizome and roots, after pounding them to a pulp, as a poultice for cuts and wounds. A tea made from these parts is also used as a remedy for cramps, headache and pulmonary disorders.

Verbascum thapsus L. (Great Mullein.) The aborigines smoked the dried leaves as a tobacco and employed the root as an expectorant.

Verbena hastata L. (Wild Vervain.) The Teton-Dakota boiled the leaves and drank the decoction for stomachache. The Menomini used a tea made from the roots for clearing up cloudy urine.

Verbena urticæfolia L. (White Vervain.) The aborigines employed this plant as an antidote for poison ivy.

Viburnum acerifolium L. (Maple-leaved Viburnum.) A tea was prepared from the inner bark by the Menomini and drunk for cramps and colic.

Viburnum Opulus L. (Cramp Bark.) The bark was used by the aborigines in a decoction as a diuretic. Some of the Western tribes smoked it as a substitute for tobacco.

Vicia caroliniana Walt. (Vetch.) The Cherokee drank a decoction for dyspepsia and pains in the back and rubbed it on the stomach for cramps. A decoction of this plant and Life Everlasting was rubbed over the affected part for rheumatism, after the skin was first scarified by scratching.

Villanova dissecta (A. Gray) Rydb. The plant was powdered and used by the Zuni for rheumatism and for pains in the head.

Viola canadensis L. (Canada Violet.) The Ojibwa used a decoction of the roots for pains in the region of the bladder.

Viola pubescens Ait. (Downy Yellow Violet.) The Ojibwa made a decoction of the roots which they took in small doses for sore throat.

Vitus cordifolia Michx. (Chicken Grape.) The seeds were used by the Menomini tribe to remove foreign particles from the eye.

Xanthium commune Britton. (Cocklebur.) The Tewa employed this plant as a remedy for diarrhœa and vomiting. They fumigated their children with it as a remedy for urinary trouble. The seeds along with seeds of the squash and those grains of corn that had been buried by crows and found by members of the Cactus Fraternity were ground together on stone slabs in the fraternity chamber. By the Zuni, this mixture is applied externally to extract cactus needles or splinters and to heal nail and other wounds. The theurgist expectorates on the wound, then on the medicine, which he applies, and pats it until it adheres firmly to the part.

Ximenesia exauriculata (Rob. and Greene.) Rydb. (Crownbeard.) The Zuni considered the flower heads of this plant a specific for cramps in the stomach. These were chewed and swallowed, after which water was drunk. The result was a copious vomiting. The roots of this plant along with other roots was used in treating rattlesnake bites.

Yucca baccata Torr. (Banana Yucca.) The roots are used by the Tewa as a washing medium. After being bruised with a stone, they are steeped in cold water. In a few minutes they are stirred briskly and rubbed with the hand until a good lather is secured. The fibrous parts are then separated from the lather.

Yucca glauca Nutt. (Soapweed Yucca.) All of the Plains tribes employed the root like soap for washing. The Pawnee and Omaha used the root in the smoke treatment.

Zanthoxylum americanum Mill. (Northern Prickly Ash.) The Western tribes used the bark of the root for colic, rheumatism and gonorrhœa. They chewed it for aching teeth and made it into an ointment with bear grease for application to ulcers and sores. The Menomini tribe used a decoction of the fruit for sores and bronchial diseases.

Zea mays L. (Indian Corn.) The Tewa used the following remedy for glandular enlargements in the neck: an ear of corn was

laid on the warm hearth near the fire and the patient placed his foot on it and rubbed it to and fro. In the course of two or three days it was claimed the swellings would subside. For palpitation of the heart, certain members of this tribe used blue corn meal mixed with water while others used corn pollen. Black corn with a streaking of red was considered a good emmenagogue.

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ABSTRACTED AND REPRINTED ARTICLES

PHARMACOLOGY OF ALCOHOL.*[1]

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Within the last forty years there has been a considerable change in the views of the medical profession concerning the pharmacology of alcohol. Formerly regarded as a stimulant, alcohol is now classed as a depressant along with ether and choloroform. This change has resulted from improved methods of study and from new viewpoints in physiology and pharmacology. Among the most important of the latter is the recognition that the animal body makes extensive use of inhibitory processes; numerous physiological activities are normally kept slowed down by higher controlling centers. When the latter are depressed by alcohol, ether, etc., the lower mechanisms are "released" with the resultant signs of stimulation such as increased activity, a more rapid heart action, etc. In other words, alcohol takes off the "brakes" and allows parts of the machinery to run faster; the result in some respects is the same as that of true stimulation, but there is this important difference: taking off the brakes will not help the machine to go up a hill as will a true stimulant.

This newer view of the action of alcohol has little bearing upon the possible usefulness of the drug in health or disease, for a depressant drug may be as valuable as a stimulant; it simply shows that proper discrimination must be employed in its use.

Nature of Poison in "Bootleg" Liquor.

There is little accurate information as to just what "bootleg" liquors contain aside from ordinary ethyl alcohol. Many very poisonous substances are contained in the various agents used to denature alcohol, but these have seldom been reported as present in bootleg liquor.

*Reprinted from *Jour. Indust. and Eng. Chemistry.*

[1] Abstracted from a paper read before the Intersectional Meeting of the Northeastern, Rhode Island, and Connecticut Valley Sections of the American Chemical Society, Boston, Mass., January 10, 1925.

The chemists of the Prohibition Office reported analyses of 75,000 samples of illicit liquor, and the chief ingredient found, which is not present to the same extent in genuine whisky, was acetaldehyde; they were inclined to attribute the deleterious effects of the spurious liquor to this substance. This explanation is not very satisfactory, however, for acetaldehyde is only seven or eight times as poisonous as ethyl alcohol itself, and in the samples analyzed there was an average about fifteen hundred times as much alcohol as acetaldehyde. An individual would have to consume almost his own weight of the liquor in order to a fatal dose of acetaldehyde; of course he would die of alcohol poisoning long before he could get a dangerous dose of the aldehyde.

The writer has tested a few samples of illicit liquor which were alleged to have cause death in man and found their toxicity for animals to be fully accounted for by the ethyl alcohol they contained; he is inclined to think that, unless the victims of such poisoning had taken something besides the liquor analyzed, the results were due to the quantity of alcohol drunk or the manner in which it was taken rather than to its quality. The depth of intoxication and the danger to life depend upon the concentration of alcohol in the blood and this is determined not only by the amount of alcohol taken but by its concentration. There is a rather small margin between the amount of alcohol necessary to cause deep intoxication and that sufficient to cause death; hence if an individual takes a large amount of strong alcohol within a short time he may get enough to cause not only intoxication but death. Deaths of this nature have frequently resulted from the taking of genuine whisky upon a wager that a given quantity could be drunk within a short period.

Methyl Alcohol Poisoning.

The view that methyl alcohol poisoning is due to impurities rather than to the methyl alcohol itself is considered to be untenable, although it seems to be true that some samples of wood alcohol contain allyl alcohol, which is much more poisonous than methyl alcohol itself, in amounts sufficient to distinctly increase the toxicity of the wood alcohol. Pure methyl alcohol, however, is much more poisonous than ethyl alcohol. The cause of this difference is obvious when the pharmacological action of the two alcohols is considered: although there are certain limitations to its use, ethyl alcohol is a food—in

fact, as much as forty per cent. of the food requirements of a man can for a time be met by ethyl alcohol—whereas methyl alcohol has, for practical purposes, no value whatever as a food. The body can quickly and almost completely oxidize (and utilize) moderate amounts of ethyl alcohol, but it has great difficulty in either destroying or excreting methyl alcohol. The latter remains in the body for long periods and, probably with its oxidation products (formic acid and probably formaldehyde), has a very injurious action, especially upon the eyes. Methyl alcohol is more volatile than ethyl alcohol and the inhalation of its vapors by painters and others has frequently caused death or blindness; one author reported sixty-eight such cases.

THE COMMONWEALTH STUDY OF PHARMACEUTICAL EDUCATION.

Bulletin No. 5.

This is the fifth of a series of twelve monthly statements to be issued by the staff conducting this study to acquaint the profession with the progress of the study.

There has been such a general request from both the publishers and readers of previous bulletins, for some of the results of the study rather than methods employed, that it was decided to include in this bulletin some general observations resulting from the survey of retail stores which was conducted last summer.

It was determined early in the study that much of the information needed to complete a report on "what knowledge, skill and ideals a pharmacist should possess" must of necessity come from the retail pharmacist. It was therefore decided to make a survey of one hundred retail stores in each of the following centers and surrounding territories:

Boston, Mass.	New Orleans, La.
Richmond, Va.	Norman, Okla.
Philadelphia, Pa.	Los Angeles, Calif.
Pittsburgh, Pa..	Seattle, Wash.
Columbus, Ohio	Salt Lake City, Utah
Chicago, Ill.	Lincoln, Neb.
Minneapolis, Minn.	Greater New York
St. Louis, Mo.	Buffalo, N. Y.

Over 1100 stores were surveyed for the following information:

1. How frequently and under what conditions the pharmacist is called up to use some knowledge of toxicology.
2. The extent to which the retail pharmacist is doing his own manufacturing.
3. How many crude drugs are handled in bulk by the present-day pharmacist.
4. How well equipped the average store is to manufacture and compound.
5. How much attention the retailer is paying to U. S. P. and N. F. methods of preservation.
6. How frequently the pharmacist is called upon to render first aid and the conditions treated.
7. How much chemical assaying the pharmacist is doing.
8. How much biological assaying the pharmacist is doing.
9. How many retail stores are equipped to do bacteriological and clinical work.
10. The type of training the pharmacist interviewed has received.
11. With what pharmaceutical organizations he is affiliated.
12. The degree to which he is co-operating in matters pertaining to public health.

The final report when published will give statistical details that cannot be published at this time. General indications as drawn from the summaries submitted by those who actually interviewed the retailers were as follows:

1. The number of times that the pharmacist is called upon to actually treat a case of poisoning is limited. He very frequently uses his knowledge of toxic doses to catch what might have been serious errors in prescriptions.
2. Retailers today are doing little manufacturing.
3. The number of crude drugs sold from open packages is decreasing but the number is still surprisingly large in many of the stores.
4. The average drug store is fairly well equipped to do compounding but very few are equipped to do much manufacturing.

5. The average pharmacist is paying very little attention to official methods of preservation.
6. Most pharmacists are practicing first aid and believe it should be included in the college curriculum.
7. Retail pharmacists are doing no chemical assaying.
8. Retail pharmacists are doing no biological assaying.
9. A very limited number of retail drug stores are equipped to do bacteriological or clinical work.
10. Of the stores surveyed about one-half were operated by a pharmacist possessing at least a Ph. G. degree or its equivalent.
11. The retail pharmacists are not taking the interest in organization work that they should.
12. In few instances are pharmacists taking their places beside the physician in matters of sanitation and public health.

As can readily be seen, much of the above is negative. The final report of the committee will carry practical suggestions as to methods of correcting many of the above conditions which are tending to divorce pharmacy from its proper professional standing.

SCIENTIFIC AND TECHNICAL ABSTRACTS

CHANGE OF SODIUM BICARBONATE TO CARBONATE IN AQUEOUS SOLUTION AT ROOM, HIGHER AND BOILING TEMPERATURES.—An aqueous solution of sodium bicarbonate decomposes at the ordinary temperature in a closed container only slightly in the course of several weeks with the formation of sodium carbonate more quickly, however, in open containers. Brief treatment of sodium bicarbonate with hot or boiling water causes only a slight change. In aqueous solution sodium bicarbonate suffers increasing change by persistent boiling. The decomposition velocity gradually diminishes, however, as accumulation of sodium carbonate progresses, 95 per cent. of the sodium bicarbonate being thus transformed over a period of five hours' boiling. This information is peculiarly interesting in con-

nection with the sterilization of sodium bicarbonate in aqueous solution previous to its intravenous injection.—Th. Sabalitschka and G. Kubisch (*Arch. Pharm.*, 262, 1924, 106 through *Chem. Abstr.*, 1924, 18, 2848).

Effect of Soil-Content on Datura stramonium L.—Dr. Maurin, of the faculty of the College of Toulouse, reports in *Bull. Sci.-Pharmacolog.* (1925, 32, 75), the results of numerous experiments to determine the relation of soil composition on the growth of *D. stramonium* and on the alkaloid content. The experiments extended over three years. He found that iron and aluminum sulphates, complete fertilizers and calcium superphosphate are beneficial both to the general growth of the plant and the production of alkaloid, but that potassium sulphate has an inhibitory action on alkaloid production although promoting the general growth. The H-ion soil-reaction was seemingly not determined. This would doubtless be an important factor in the case.

H. L.

Bromine from Sea Water.—The modern demands for bromine in some industrial operations such as motion picture work, general photography, medicine, and for the ethylene bromide now used in motor fuel, have led to a peculiar development in obtaining this element. The ship "Lake Herminia," formerly the property of the United States Shipping Board, has been purchased by a manufacturing corporation, renamed "Ethyl," and is to be used for extracting bromine from sea water. The ship is a 4300-ton deadweight capacity, and has been fitted up with machinery of an improved character for the purpose of treaitng the sea water. As the ship will operate on the high seas there will be no appreciable nuisance from either fumes or the discharged liquid. It is stated that 1700 gallons of sea water contain one pound of bromine. The method which has been adopted has been proved by laboratory tests to be satisfactory.

H. L.

Propylene as an Anesthetic.—Propylene, a gas closely related to ethylene, whose usefulness as an anesthetic was one of the sensational medical discoveries of the past year, has been found to

possess similar powers, of such high quality that it may rival or even supplant its sister compound. Its properties were described at the Baltimore meeting of the American Chemical Society by Dr. Lloyd K. Riggs and Harold D. Goulden, of the research laboratories of E. R. Squibb & Sons, at New Brunswick, New Jersey.

In the course of the experiments, in which large numbers of rats were used, it was found that a mixture of 70 per cent. of propylene with 25 per cent. oxygen and 5 per cent. nitrogen rendered the animals insensitive to pain in one minute and caused them to relax into complete unconsciousness in two. Used too long, propylene is poisonous, but there is a wide margin of safety, for about sixteen minutes' time was required before the rats' respiration failed, under the conditions of the experiment.

No long-range ill-effects were observed to follow the use of the gas. A number of female rats were experimented with specifically on this point and, although they were used day after day in the tests, they remained in good health, gained weight rapidly, and bore litters of normal young. As a consequence of their experiments, the investigators recommend the clinical use of propylene.

Propylene, like ethylene, is an ingredient of common illuminating gas, and is also obtained as a by-product in petroleum refining.

Facts and Fallacies About Wood.—Dr. L. F. Hawley, of the United States Forest Service, before the annual meeting of the American Chemical Society, took occasion to deny a number of popularly accepted but erroneous ideas in connection with wood.

After disposing of what he characterized as the complimentary but untrue notion that a chemist can tell all about what a given kind of wood is good for, merely by analyzing it, Dr. Hawley took up a few of his "seventeen fallacies" in detail.

"It is not true," he stated, "that wood from trees cut in summer is much less resistant to decay than that cut in the winter. The apparent difference in durability is due to the conditions for decay being more favorable during the summer than during the winter, and not to any seasonal difference in the chemical composition of the wood.

"Neither is it true that blue-stained wood is weaker than similar unstained wood. The fungus that causes the stain feeds on the starches and sugars in the wood, and not on the wood itself.

"The idea that wood can be so modified by treatment that it no longer absorbs moisture and therefore no longer shrinks or swells, is wrong. The attraction of wood for moisture is so great that there are very few coatings which are able to do more than retard the process of absorption.

"There are several erroneous ideas about pines that have been tapped for turpentine. Some people think that pine trees which have been turpentined furnish a less resinous and a weaker wood than unturpentined trees, that the sapwood of long-leaf pine contains more resin than the heartwood, and that resin is produced in longleaf pinewood after the tree is cut. These ideas have all been shown to be erroneous.

"Finally, there is no easy way to get rid of stumps, such as boring holes and filling them with kerosene or saltpeter and setting them on fire, or by pouring a corrosive chemical into the hole. The first method sounds well in theory, but doesn't work when it is tried. And as for the chemical, we do not know of one that will do the work."

Chinese Tung Oil From Florida.—Very definite advances are being made in developing an American source for tung oil, one of the basic materials used in the manufacture of varnish and linoleum, according to a report submitted by C. C. Concannon, Chief of the Chemical Division of the Department of Commerce to Secretary Hoover.

A report recently received from Gainsville, Florida, describes extensive experiments in tung tree culture now being carried on by the American Tung Oil Corporation. Although the groves were only laid out in November, 1923, more than 25,000 trees are now under cultivation and it is expected that the plantations will be on a self-sustaining basis in two more years. The trees are in a particularly virile condition, and high hopes are held out by the organizers of the project. All that is needed for the success of the venture, according to directors of the project, is to awaken Florida landowners to what they can accomplish in this industry and to show them that a profitable branch of agriculture is waiting development. A great deal of missionary work has already been done in this direction and thousands of tung oil seedlings have been distributed to farmers.

At present China is the one dominant source of tung oil supply. Recurrent political disturbances have given rise to violent price fluctuations which have seriously affected American consumers. As a result this experimental project was launched for the purpose of serving a secondary source of tung oil that would make the paint and varnish industry at least independent in part of the exactions and uncertainties brought about by the one source of supply being confined to China.

With imports of tung oil now running well over a million dollars a month and with the varnish industry annually enlarging its productive capacity, it is pointed out that some alternative source of supply is necessary.

The progress made in Florida has been widely broadcast in China and it is contended by responsible officials of the Paint and Varnish Association that a marked effect has been noticeable on the tung oil market.

NEWS ITEMS AND PERSONAL NOTES

College News.—The student assemblies at the Philadelphia College of Pharmacy and Science are attracting much attention and interest since they have been changed to a time of day when all classes can attend simultaneously. It is certainly an inspiration to a speaker to have an audience of more than 500 earnest young men and women listening to his words.

Ex-Governor Stuart of Pennsylvania, and Colonel Collier, Director of the Sequi-Centennial Exposition are among those who recently addressed the assembly.

The first Wednesday in each month is given over to the senior class to arrange the program.

On April 1st the senior class program was particularly good. The B. Sc. Orchestra played a number of selections. Mr. Biscontinue, Ph. G., '25, sang several songs, including "O Sole Mio." Miss Baillargeon, of Montreal, B. Sc., '26, played one of Kreisler's violin compositions with piano accompaniment, and Professor A. B. Nichols sang a popular song with the class joining in the chorus.

On Monday evening, March 30th, about twenty-five students of the College who had participated in the events of Founders' Day

celebration were entertained at a dinner given by the faculty of the College, of which about thirty-five members were present. The dinner was held in the dining-room on the seventeenth floor of the Hotel Longacre and was delightful both so far as material things were concerned and in the immaterial but enjoyable spirit which pervaded the occasion. There was no set program. Professor LaWall acted as the toastmaster and simply let the events develop as the occasion provided. Speeches were made by members of the faculty and by students; co-operation of student activities was the keynote of the evening's remarks.

Mr. Clyde L. Eddy, of New York, one of the vice-presidents of the American Pharmaceutical Association, was present as a guest of the occasion, and made a few remarks just before adjourning.

The student activities are being augmented constantly. There are now two orchestras, a dramatic club, and a student paper, in addition to various class book and fraternity activities, all of which make for good fellowship and better educational progress.

Sir W. S. Glyn-Jones's Visit to Canada and the United States.—On the invitation of representative interests in Canada, Sir W. S. Glyn-Jones has arranged to visit the principal centres in the Dominion. Accompanied by Lady Glyn-Jones and his younger daughter, he is leaving on March 27, by the SS. "Montclare," for St. John, New Brunswick, being due home about the end of May. Most of the time of his visit will be spent in Canada, with possibly a week or ten days in the United States towards the end of it. Primarily, Sir William is going out to see if he can be of any service in helping to improve the conditions under which many pharmaceutical products are being sold by wholesale and retail in the Dominion, but he also hopes to be able to avail himself of the opportunity of learning all that he can concerning the academic and professional side of pharmacy in Canada, and, if time permits, in the United States. As the visit has been arranged hastily, a detailed itinerary has not yet been mapped out, so that, from the 27th instant until further notice, all communications from American correspondents should be addressed to him, in care of Canadian Pacific Office, Montreal.

A NEW MANUFACTURING HOUSE, THE HARVEY-PITTENGER COMPANY.—Dr. Paul S. Pittenger, for fifteen years director of the pharmacodynamic laboratories of the H. K. Mulford Company, Philadelphia, has resigned to become the president of the Harvey-Pittenger Company, recently incorporated. Dr. Pittenger is well known to pharmacists in the United States through his lecture work as professor of physiologic assaying at the Philadelphia College of Pharmacy and Temple University, Philadelphia, and as a frequent contributor to the literature of the profession. At the present time he is first vice-president of the A. Ph. A., and also chairman of the Scientific Section and chairman of the Committee on Physiologic Assaying of that organization. He is also a member of the U. S. P. Revision Committee.

Dr. Pittenger's partner in the new enterprise is Gilbert L. Harvey, of Philadelphia, who has served as instructor in bacteriology at the P. C. P. & S. and as assistant director of the manufacturing departments of the National Drug Company, Philadelphia, with whom he has been connected for the past twenty-one years. The new company will devote its efforts to the manufacture of a high class pharmaceutical specialty line, including physiologically assayed and standardized preparations, endocrine products, and sterile solutions for direct medication.

UNITED STATES CIVIL SERVICE EXAMINATION.—The United States Civil Service Commission announces the following open competitive examination:

CHEMIST (PHARMACEUTICAL).

Receipt of applications for chemist (pharmaceutical) will close May 12. The examination is to fill a vacancy in the Bureau of Chemistry, Department of Agriculture, Washington, D. C., and vacancies in positions requiring similar qualifications.

The entrance salary for this position is $3800 a year. Advancement in pay may be made without change in assignment up to $5000 a year. Promotion to higher grades may be made in accordance with the civil service rules.

The duties are to conduct researches leading to the discovery of active plant principles in vegetable drugs and to develop procedures

for the identification, isolation or separation of such constituents; also to develop methods of analysis for drugs; to modify existing methods of analysis for drugs for the purpose of making them more accurate; to co-operate with Government officials, with pharmaceutical chemists in the drug industry and with universities and colleges in the matter of research in the discovery and isolation of active principles in plants and the development and modification of methods for the analysis of drugs.

Competitors will not be required to report for examination at any place, but will be rated on their education, training, and experience, and writings to be filed with the application. Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D. C., or the secretary of the board of United States civil service examiners at the post office or customhouse in any city.

New Research Institute for Pharmacy to Benefit Public.—The officers of the American Pharmaceutical Association have just issued a statement on a new Research Institute to be established by pharmacy for the benefit of the public. The announcement calls attention to some of the important discoveries and contributions by pharmacists and especially to the scientific research laboratory for the study of drugs and medicines. The statement which has been prepared by President C. W. Holton, Newark, New Jersey; Dean W. B. Day, Secretary, University of Illinois, Chicago, and Dr. E. L. Newcomb, Publicity Director, University of Minnesota, Minneapolis, reads as follows:

"Since the earliest times pharmacists have rendered to the public valuable service in the discovery and improvement of medicines.

"In 1776, Peter J. A. Daries, a pharmacist, discovered that the drug Belladonna caused dilation of the pupil of the eye. Ever since, preparations of this drug have been extensively used by physicians, surgeons and optometrists with the unquestionable result that eyesight has been saved to thousands upon thousands of people.

"In 1816, Friedrich W. A. Serturner, pharmacist of Eimbeck, in Hanover, enriched science with the discovery of morphine. This drug has undoubtedly relieved more human suffering than any other medicinal agent. It is true that morphine has been grossly misused.

Government and other statistics show that over 99 per cent. of the misuse of morphine is by others than physicians or pharmacists. The latter are primarily responsible for our present strict laws prohibiting the improper use of morphine, and this in view of the fact that these laws place onerous burdens upon pharmacists and physicians.

"For over fifty years the pharmacists of the United States have provided scientific standards for the supply of pure, unadulterated drugs and medicines to the public. Today physicians and the public at large have medicines the standards for which are not equaled in any other country.

"In 1906 the United States Government accepted these drug standards prepared by pharmacists as the legal standards for enforcement of the Food and Drugs Act. At this time a committee of over thirty pharmacists of the United States are giving gratuitously of their time and scientific knowledge to keep these standards abreast with modern research.

"The pharmaceutical interests of the United States are now engaged in the work of establishing a great central Headquarters Building. One of the chief features of this institution will be a complete scientific research laboratory for the study of drugs and medicines.

"The completion and operation of this new institution will bring many advantages to pharmacy. To the public it will bring the results of new research for the lasting benefit of all mankind."